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COMMENTARY ON THE NORTH AMERICAN GENERA OF COMMELINACEAE

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During the course of a revision of the species of *Tradescantia* indigenous to the United States, published several years ago,[1] I found it advisable to make some correlative observations upon the genus as a whole and the American representation of the family generally. These rather casual excursions afield were both comforting and disquieting, for they showed that, although the Tradescantias of the United States are relatively homogeneous phylogenetically, those of the tropics are extremely heterogeneous, and also that the systematics of the family, at least in North America, is very precarious indeed. Such being the case, I fixed my attention upon the limited job in hand with a profound sense of thanks to Providence for my lot at that time, and a nebulous vow of propitiation by a revision of the tropical Spiderworts in the indefinite future. The "future" has arrived rather unexpectedly at last, for I find my vow exacted by the needs of the 'Flora of Panama' upon which I have been working for some years past.

The Commelinaceae always have been difficult subjects for herbarium study because of their deliquescent flowers. It is not easy to understand, therefore, why previous systematists of the family have focused almost their whole attention upon floral structure in the delimitation of subfamilies, tribes, and genera. In his account of the family for de Candolle's 'Monographiae', C. B. Clarke[2]

[1] Anderson, E., and R. E. Woodson, Jr. Contr. Arnold Arb. 9: 1–132. 1935.
[2] C. B. Clarke, in A. & C. DC. Monogr. 3: 115–324. 1881.

erected three tribes, Pollieae, with fruit indehiscent, Commelineae, with dehiscent fruit, fertile stamens 3–2, sterile stamens 0–4, and Tradescantieae, with dehiscent fruit, fertile stamens 6–5. In establishing these groups, Clarke found it prudent, in the case of the last two tribes, to call attention to exceptions amongst a number of genera obviously included arbitrarily within either tribe in spite of divergence from the characters of diagnosis. The modern reader probably will find it difficult to understand why *Phaeosphaerion (Athyrocarpus)* was placed within the Pollieae, whilst *Commelina* remained with several discrepant genera in the Commelineae, as well as why *Callisia* was placed within the Tradescantieae, upon the characters provided, since the greater number of its species (as interpreted by Clarke himself) have only 1 to 3 stamens. Numerous other instances of ambiguity and inconsistency could be mentioned.

The most recent general system of Commelinaceae is that by Brückner[3] for Engler's 'Natürlichen Pflanzenfamilien', in which two subfamilies are provided: Tradescantieae, with actinomorphic flowers, and Commelineae, with flowers zygomorphic. With such distinctive terms employed in the general key, the reader is prone to remember the regular flowers of *Tradescantia* and the strongly irregular flowers of *Commelina* (as he is apt to be acquainted with them), and to proceed on his way until tripped by the deliquescent flowers from the herbarium before him or stopped dead in his tracks by a reference to the text of the generic descriptions of Commelineae. These usually side-step the issue of zygomorphy entirely or admit inconsistency (as for *Aneilema,* p.175: "Pet. frei, das äussere *mitunter* kleiner" [italics mine]). Reference to herbarium specimens and to standard icones shows that in most genera the zygomorphy of the corolla is either absent or so slight that it is highly impractical. Brückner further divides the Tradescantieae into two tribes, Hexandrae and Triandrae, upon the basis of "6 fertile Stam." and "3 fertile Stam., 3 oder O sterile", respectively. The latter, of course, is highly embarrassing to such a genus as *Callisia,* the fertile stamens of which vary from 1 to 6, without accompanying staminodes.

Generic characters used by both Clarke and Brückner, as well as by less prominent authors, have tended to accentuate the stamen constituency, as number of fertile stamens, presence of staminodia, bearding, etc. My general impression, based upon observations of

[3] Brückn. in Engl. & Prantl, Nat. Pflanzenfam. **15a:** 159–181. 1930.

such genera as *Callisia* and *Tripogandra (Descantaria),* is that the stamens of the family show great variation frequently amongst species of a single genus. An outstanding example of the impracticality of Brückner's application of staminal characters is provided by his inclusion of *Descantaria* within the Hexandrae and *Neodonnellia* within the Triandrae. Even a casual examination of representative species shows that the outer stamens of both are essentially alike.

In making a major subdivision of the Commelinaceae, I would base my separation upon inflorescence structure. In the entire family the basic inflorescence design is the scorpioid cyme. But in the Commelineae, as I distinguish the tribe, the ultimate branches or units of the inflorescence are composed of individual scorpioid cymes which appear 1-sided superficially; these may be solitary or variously compounded even in a given species, or very rarely reduced to a solitary flower. In my interpretation of the Tradescantieae, on the other hand, the basic structure of the inflorescence has been modified so that the ultimate branches or units of the inflorescence are *paired sessile* scorpioid cymes which appear as a 2-sided unit superficially, rarely reduced to a solitary flower.

Very little experience is necessary both to distinguish these types of inflorescence and to appreciate their validity. At first, the observer may confuse occurrences of separate but superficially paired inflorescences of the Commelineae type with the more highly evolved type characteristic of the Tradescentieae. But closer examination of such specimens (as in *Tinantia leiocalyx* Clarke) will show that pairing here is merely a numerical chance and not a concrete unit of structure as in the whole tribe Tradescantieae. The paired cymes of *Tradescantia* and its near relatives, also, are likely to cause trouble at first, because they are so condensed. But superficially they usually will appear 2-sided or ''parted in the middle'', which a dissection or closer examination will confirm.

The paired cymes of the Tradescantieae are considered to be an integral condensation derived from the individual cymes of the Commelineae. Amongst the genera of this tribe condensation proceeds within the limits of the paired cyme. In the genus *Tripogandra* the paired cymes are borne at the tip of a common naked peduncle which usually is elongate, although greatly foreshortened in *T. Warscewicziana,* a species somewhat transitional to *Callisia.* These pedunculate cymes may be terminal or axillary to a stem

leaf and solitary or in clusters. The few to many flowers of each cyme are subtended by rather inconspicuous bracteoles which ordinarily are hyaline or somewhat petalaceous, only rarely slightly foliaceous, and are disposed in two imbricated series upon either side of the axis.

In the remaining genera of Tradescantieae, typified most familiarly by *Tradescantia (sensu stricto),* the paired cymes are sessile, and are borne in the axils of bracts which are more or less leaf-like. These bracts, therefore, are oriented at a divergence approaching 90° to the position of the bracteoles of the cymes proper. It appears fairly obvious, then, that the bracts of *Tradescantia* and its closest relatives are merely subterminal foliage leaves which subtend the sessile umbelliform cymes through the complete reduction of the peduncle so manifest in *Tripogandra.*

These remarks pertain particularly to the terminal or pedunculate lateral inflorescences of the Tradescantias. Still more pronounced modification is found in further reductions in sessile lateral inflorescences, as may be seen in such a common species as *T. canaliculata.* In this species the bracts are reduced proportionally to the shortening of the lateral peduncule until they are demonstrated only with difficulty in completely sessile cymes; thus the single foliage leaf of the main stem comes to subtend the paired cymes previously terminal to a lateral, 2-bracted branch. In the same species such condensations of lateral inflorescences frequently, if not almost invariably, occur in conjunction with the terminal inflorescences of the main stem, resulting in a congested flower head capable of resolution into basically paired cymes only with rather careful dissection and balanced interpretation. The conclusion of this trend of reduction is attained in *T. nana* Mart. & Gal. in which both the terminal and lateral inflorescences consist of a solitary, sessile flower.

As separated on the inflorescence structure, the Commelineae include genera of both hemispheres, whilst the Tradescantieae are entirely confined to the Americas. I view the latter as being the more recent, not only upon the basis of distribution and morphological philosophy of the inflorescence, but also for a reason that my readers may soon appreciate: the differentiation of the genera is much the more flexible, so much so, in fact, that not infrequently it will be necessary to invoke a combination of characters, as is often done for families and orders. These "genera" of Tradescan-

tieae are more to be construed as evolutionary tendencies still in the process of differentiation than as distinct entities in sharp focus. Nevertheless, I am reasonably confident of the validity and convenience of the groups as they stand here.

In separating genera, I usually have found that there are sufficient characters without employing some of the more difficult criteria of my eminent predecessors which, if applied consistently, would increase the number of groups, obscure phylogenetic lines, and render identification even more difficult, at least in the herbarium. In short, my view of the North American genera of Commelinaceae is that expressed in the key which follows. Although designed particularly for North and Central America, including the Antilles, the key will be found of use in the southern continent, where nearly the same representation occurs, with the addition of two or three other groups which are not likely to cause trouble. In order to clarify my position the better, I have appended a few comments on the revised generic lines, as well as some of the more obvious nomenclatural adjustments necessary. These changes are based only upon species with which I am familiar at present, and are not complete compilations. With the advent of better World political conditions, a monographic treatment of the whole group will be in order.

KEY TO THE GENERA

a. Ultimate branches of the inflorescence composed of individual scorpioid cymes appearing 1-sided superficially, solitary or variously clustered, very rarely reduced to a solitary terminal flower; corolla regular or irregular *(Commelineae)*.
- b. Cymes variously clustered or compounded, rarely solitary, but never enclosed by a spathaceous bract.
  - c. Fertile anthers separate; plants caulescent, terrestrial.
    - d. Anthers large, with an inconspicuous connective, dehiscing by apical pores; seeds with a fleshy aril..........................I. DICHORISANDRA
    - dd. Anthers small, but with a conspicuous sterile connective, dehiscing longitudinally; seeds dry.
      - e. Ovary and capsules 3-celled.
        - f. Flowers regular or essentially so........................II. ANEILEMA
        - ff. Flowers very strongly irregular........................III. TINANTIA
      - ee. Ovary and capsules 2-celled.............................IV. FLOSCOPA
  - cc. Fertile anthers fused into a cochleate hood; large acaulescent epiphytes ....V. COCHLIOSTEMA
- bb. Cymes solitary, enclosed by a conspicuous spathaceous bract.
  - c. Fruits dehiscent, capsular; sterile stamens (when present) with cruciate anthers .... VI. COMMELINA
  - cc. Fruits indehiscent, pergamentaceous; sterile stamens with hastate-triangular anthers..................................VII. PHAEOSPHAERION

aa. Ultimate branches of the inflorescence composed of paired sessile scorpioid cymes appearing as a 2-sided unit superficially, rarely reduced to a solitary flower; corolla regular *(Tradescantieae)*.
  b. Corolla apopetalous, the petals free to the base.
    c. Paired cymes distinctly pedunculate, never sessile and subtended by leafy bracts (but the bracteoles rarely somewhat foliaceous in part); stamens 6, usually in 2 very dissimilar series, the outer occasionally sterile, rarely all fertile and essentially similar; sepals foliaceous or petalaceous............ ....VIII. Tripogandra
    cc. Paired cymes sessile and subtended by more or less conspicuous leafy bracts, rarely appearing pedunculate and the bracts greatly reduced, but the stamens usually 1–3, rarely 6, all fertile, and the sepals paleaceous....IX. Callisia
    ccc. Paired cymes sessile and subtended by conspicuous bracts essentially similar to the leaves (coriaceous spathes in *Rhoeo)*; stamens 6, all fertile and essentially similar; sepals foliaceous or petalaceous.
      d. Cymes on slender peduncles lateral to the main stem.
        e. Flowering peduncles elongate, usually branched; bracts foliaceous; sepals becoming fleshy in fruit.............................X. Campelia
        ee. Flowering peduncles very short, simple; bracts appearing as coriaceous spathes; sepals drying in fruit..........................XI. Rhoeo
      dd. Cymes terminal to the main stem, occasionally also lateral in the upper leaf axils; lateral cymes very rarely reduced to a solitary flower........ ....XII. Tradescantia
  bb. Corolla gamopetalous, the petals united at the base.
    c. Flowers borne in leafy-bracted cymes; corolla tube relatively short; plants with extensive creeping stems.
      d. Sepals separate, foliaceous; plants tumid................XIII. Setcreasea
      dd. Sepals united into an unequally-lobed tube, hyaline; plants somewhat succulent, but not tumid.................................XIV. Zebrina
    cc. Flowers solitary and sessile in the axils of the congested upper leaves; corolla tube long and slender; semiacaulescent alpines........XV. Weldenia

I. Dichorisandra Mikan, Del. Fl. & Faun. Bras. *pl. 3.* 1820; C. B. Clarke in A. & C. DC. Monogr. **3**: 272. 1881; Brückn. in Engl. & Prantl, Nat. Pflanzenfam. **15a**: 170. 1930, nom. conserv.

? *Stickmannia* Neck. Elem. **3**: 171. 1791, nom. rejic.

Petaloxis Raf. Fl. Tellur. 2: 83. 1836 [1837].

This is one of the most distinctive genera of Commelinaceae, as is shown particularly by the anthers and arillate fruit. The petals, also, are much more resistant to deliquescence than those of other Spiderworts. The genus is best represented in Brazil, from whence nearly 30 species have been described, mostly spurious, I suspect upon the basis of familiarity with the common and highly variable *D. hexandra* (Aubl.) Standl. in Panama.

II. Aneilema R. Br. Prodr. 270. 1810; C. B. Clarke, loc. cit. 195. 1881; Brückn. loc. cit. 174. 1930.

Murdannia Royle, Illustr. Bot. Himal. 403. *pl. 95.* 1839 [1840]. Brückn. loc. cit. 173. 1930; also numerous other Asiatic and African synonyms for both genera enumerated by Clarke and Brückner.

I am placing within *Aneilema* the erstwhile species of *Tradescantia* having simple scorpioid cymes as component units. This is an entirely natural procedure as anyone who examines a suite of the large Asiatic and African genus will see. Why these plants were ever placed within *Tradescantia* in the first place is hard to understand. The Old World species of *Aneilema* present much variation in inflorescence modification, and it is significant to find that those of America follow much the same system of variation. Although *Aneilema (sensu stricto)* was placed in the Commelineae and *Murdannia* in the Tradescantieae by Brückner, it seems quite obvious to me that the two are congeneric. The irregularity of the corolla of the former, as Brückner himself confesses, is only occasional ("Pet. frei, das äussere mitunter kleiner", p.175); while the same, oddly enough, can be said for the regularity in *Murdannia* ("Pet. frei, mitunter das äussere wenig anders gestaltet", p.173).

ANEILEMA **chihuahuensis** (Standl.) Woodson, comb. nov.
Tradescantia chihuahuensis Standl. Field Mus. Publ. Bot. **17**: 227. 1937.

ANEILEMA **geniculata** (Jacq.) Woodson, comb. nov.
Tradescantia geniculata Jacq. Select. Stirp. Amer. 94. *pl. 64.* 1763; C. B. Clarke, loc. cit. 300. 1881.

ANEILEMA **Greenmanii** Woodson, nom. nov.
Tradescantia macrophylla Greenm. Proc. Amer. Acad. **33**: 472. 1898, non *Aneilema macrophylla* R. Br.

ANEILEMA **holosericea** (Kunth) Woodson, comb. nov.
Dichorisandra longifolia Mart. & Gal. Bull. Acad. Brux. **9**^{2}: 378. 1842, non *Aneilema longifolia* Wall. nec Hook.
Tradescantia floribunda Mart. & Gal. loc. cit. 377. 1842, non *Aneilema floribunda* Hook. & Arn.
Tradescantia holosericea Kunth, Enum. **4**: 92. 1843; C. B. Clarke, loc. cit. 302. 1881.
Tradescantia holosericea Kunth β. *dracaenoides* C. B. Clarke, loc. cit. 1881.
Tradescantia longifolia (Mart. & Gal.) Greenm. Proc. Amer. Acad. **33**: 471. 1898.

Tradescantia dracaenoides (Clarke) Greenm. Proc. Amer. Acad. **39**: 70. 1903.

Certain of the several varieties of this species, as enumerated by Clarke, may well be entitled to specific rank, others appear questionable even as varieties. This is a question that must await monographic study.

ANEILEMA **Karwinskyana** (R. & S.) Woodson, comb. nov.

Tradescantia Karwinskyana R. & S. Syst. **7**: 1165. 1830; C. B. Clarke, loc. cit. 299. 1881.

ANEILEMA **linearis** (Benth.) Woodson, comb. nov.

Tradescantia linearis Benth. Pl. Hartweg. 27. 1839; C. B. Clarke, loc. cit. 298. 1881.

Tradescantia graminifolia Mart. & Gal. loc. cit. 378. 1842.

Tradescantia venustula Kunth, Enum. **4**: 87. 1843; C. B. Clarke, loc. cit. 298. 1881.

Tradescantia rhodantha Torr. Bot. Mex. Bound. Surv. 225. 1859.

Tradescantia linearis Benth. β. *graminifolia* (Mart. & Gal.) C. B. Clarke, loc. cit. 299. 1881.

ANEILEMA **pulchella** (HBK.) Woodson, comb. nov.

Tradescantia pulchella HBK. Nov. Gen. & Sp. **1**: 262. 1815 [1816]; **7**: *pl. 673.* 1825; C. B. Clarke, loc. cit. 297. 1881.

III. TINANTIA Scheidw. in Otto & Dietr. Allgem. Gartenzeit. **7**: 364. 1839; C. B. Clarke, loc. cit. 285. 1881; Brückn. loc. cit. 175. 1930, nom. conserv.

Pogomesia Raf. loc. cit. 67. 1836 [1837]. nom. rejic.

I have criticized Brückner in his use of regularity or irregularity of the corolla so severely in preceding paragraphs, that I find it necessary to apologize for my use of the same character in distinguishing *Aneilema* and *Tinantia.* As I have explained (p. 147), however, the irregularity of the corolla of *Aneilema* and the irregularity of *Murdannia* as applied by Brückner is merley a variable comparison of size of the petals. The flowers of *Tinantia,* on the other hand, are as incontestably irregular as are those of *Commelina,* not only in size of the petals, but in their coloration and structure of the stamens. The species of *Tinantia* are extremely variable in the size of the plants and the degree of compounding of their inflorescences.

IV. Floscopa Lour. Fl. Cochinch. 192. 1790; C. B. Clarke, loc. cit. 265. 1881; Brückn. loc. cit. 176. 1930.

Dithyrocarpus Kunth, loc. cit. 76. 1843.

I regard *Floscopa* as very closely related to *Tinantia*, with which I would unite it were it not for the 2-celled ovary and capsules. The common species of Central America, *F. robusta* (Seub.) Clarke, sets seeds with the most astonishing abundance and rapidity.

V. Cochliostema Lem. Illustr. Hort. **6**: Misc. 70. *pl. 217*. 1859; C. B. Clarke, loc. cit. 231. 1881; Brückn. loc. cit. 180. 1930.

This magnificent monotypic genus has recently been discovered in Panama. The thick indument of the petal margins is remarkable, as it is composed of beaded hairs similar to those of the staminal filaments of the family generally.

VI. Commelina L. Sp. Pl. 60. 1753; C. B. Clarke, loc. cit. 138. 1881; Brückn. loc. cit. 177. 1930, also numerous synonyms supplied by Clarke and Brückn.

Sauvallea Wright in Sauv. Fl. Cub. 156. 1873.

Commelinantia Tharp, Bull. Torrey Club **49**: 269. 1922.

The genus *Commelina* is represented by more species in the Old than in the New World. Amongst the Old World species are found many startling morphological departures, as judged from the species of the United States, including forms with 2- or 3-loculed ovaries, others with variable numbers of flowers or even stamens, wide variations in bearding of stamens, and in relative size of the petals. Such being the case, it seems in every way better to combine *Sauvallea* and *Commelinantia* within the inclusive genus.

Commelina **anomala** (Torr.) Woodson, comb. nov.

Tradescantia anomala Torr. Bot. Mex. Bound, Surv. 225. 1859.

Tinantia anomala (Torr.) C. B. Clarke, loc. cit. 287. 1881.

Commelinantia anomala (Torr.) Tharp, Bull. Torrey Club **49**: 269. 1922; Brückn. loc. cit. 176. 1930.

The interested reader should refer to Dr. Tharp's full account of the reasons for regarding this species as a distinct genus. I do not think it necessary to answer his arguments in detail, for that would entail an extended discussion of morphology with particular regard to the Asiatic species of *Commelina* beyond immediately profitable ends. The student of Commelinaceae who reads this inadequate paragraph, however, may be sufficiently familiar already with the

variable species of the Old World and with the perplexing variability of the whole family, for that matter, and probably will well understand the taxonomic confusion in the family that would be caused by over-evaluation of such characters as bearding of the stamens, etc., etc.

In the Gray Herbarium Card Index there is already an entry for "*Commelina anomala* Torrey" ex Tharp, loc. cit., so a word of explanation for the new combination here is necessary. The source of the Card Index entry is a footnote to Dr. Tharp's paper on *Commelinantia* (Bull. Torrey Club **49**: 269. 1922), which explains that Dr. Torrey first determined the type specimen as "*Commelyna anomala* Torr.", later striking out the "*Commelyna*" and substituting "*Tradescantia*". It seems quite clear that this publication in Dr. Tharp's footnote cannot be maintained as valid, as it violates Article 40 of the International Rules, being patently citation as a synonym.

COMMELINA **Blainii** (Wright) Woodson, comb. nov.

Sauvallea Blainii Wright, loc. cit. 157. 1873; C. B. Clarke, loc. cit. 315. 1881; Brückn. loc. cit. 171. 1930.

The distinctive characters of *Sauvallea* are the 6 fertile stamens and the solitary flowers, which, however, are enclosed within the characteristic spathe of the familiar Commelinas. The petals are subequal. These variants from the general run of Commelinas, however, are of the sort not found to be good generic criteria in the Commelinaceae, and even Clarke called attention to the similarity to *Commelina*.

VII. PHAEOSPHAERION Hassk. Flora **49**: 212. 1866; C. B. Clarke, loc. cit. 135. 1881.

Athyrocarpus Schlecht. Linnaea **26**: 454. 1853; Brückn. loc. cit. 179. 1930.

Phaeosphaerion is recognized here since there can be no doubt that *Athyrocarpus* was merely a suggested segregation from *Commelina* as far as Schlechtendal was concerned, and no formal transfer was made under *Athyrocarpus*.

VIII. TRIPOGANDRA Raf. Fl. Tellur. **2**: 16. 1836 [1837], emend.

Heminema Raf. loc. cit. 17. 1837.

Descantaria Schlecht. Linnaea **26**: 140. 1853; Brückn. loc. cit. 171. 1930, nom. subnud. provis.

Disgrega Hassk. Flora **49**: 215. 1866, nom subnud.
Leptorhoeo C. B. Clarke in Hemsl. Diagn. Pl. Nov. 55. 1880; C. B. Clarke, loc. cit. 317. 1881; Brückn. loc. cit. 167. 1930.
Cuthbertia Small, Fl. Southeast. U. S. 237. 1903.
Donnellia C. B. Clarke, Bot. Gaz. **33**: 261. 1902.
Neodonnellia Rose, Proc. Biol. Soc. Wash. **19**: 96. 1906; Brückn. loc. cit. 174. 1930.

Tripogandra, Heminema, Descantaria, Disgrega, Donnellia, and *Neodonnellia* all were erected to include species, previously placed in *Tradescantia,* having two greatly dissimilar stamen series, the outer with shorter filaments and anthers (occasionally sterile) quite different from those of the inner. Species of *Leptorhoeo* and *Cuthbertia* have essentially similar stamens, but without the foliaceous bracts of *Tradescantia (sensu stricto).* In addition, the former is supposed to be distinguished by having the seeds solitary in the locules of the capsules.

Tripogandra is emended here to include these numerous elements for the following reasons: (1) It is obvious to any student of the *Tradescantia* complex that there is a marked tendency towards inequality of the stamens throughout; even in the *Descantaria* group such characters as the bearding of the stamens are quite variable, and could be made the basis of further dubious generic segregations, which are devoutly to be avoided; (2) seed number in the locules of the capsules varies amongst individual plants of a single species (cf. Anderson & Woodson, Contr. Arnold Arb. **9**: 27–29. *pl. 7.* 1935). In my revision with Anderson, to which reference has been made, *Cuthbertia* was included with *Tradescantia,* for it was not at that time realized that the bracts of the latter were wholly lacking in the former. It is now recognized that such is the case (cf. p. 143, paragraph 3, of this paper), and that the foliaceous structures at first interpreted as bracts are in reality the lower bracteoles of the paired cymes, as is shown by their orientation.

I do not understand why *Descantaria* was taken up by Brückner, as Schlechtendal published it merely as a suggested segregation from *Tradescantia,* without a description, as a matter of fact without even indicating valid reasons for separating it, and without making any formal transfers of species. *Tripogandra* and *Heminema,* on the other hand, are quite well described as Rafinesquian genera go, and there can be no doubt of their application. Characteristically, both genera consist of the same species, *Tradescantia*

multiflora, although Rafinesque credits one to Schwarz and the other to Jacquin.

Tripogandra **amplexicaulis** (Kl.) Woodson, comb. nov.
Tradescantia amplexicaulis Kl. ex C. B. Clarke, loc. cit. 304. 1881.
Descantaria amplexicaulis (Kl.) Brückn. loc. cit. 1927; loc. cit. 1930.

Tripogandra **angustifolia** (Rob.) Woodson, comb. nov.
Tradescantia angustifolia Rob. Proc. Amer. Acad. **27**: 185. 1892.
Descantaria angustifolia (Rob.) Brückn. Notizblatt **10**: 56. 1927; Brückn. in Engl. & Prantl, loc. cit. 171. 1930.

Tripogandra **cumanensis** (Kunth) Woodson, comb. nov.
Tradescantia cumanensis Kunth, Enum. **4**: 96. 1843; C. B. Clarke, loc. cit. 306. 1881.
Descantaria cumanensis (Kunth) Schlecht. ex Brückn. loc. cit. 1927; loc. cit. 1930.

Tripogandra **Disgrega** (Kunth) Woodson, comb. nov.
Tradescantia Disgrega Kunth, loc. cit. 97. 1843; C. B. Clarke, loc. cit. 305. 1881.
Disgrega mexicana Hassk. ex C. B. Clarke, loc. cit. 1881, nom. nud. in synon.
Descantaria Disgrega (Kl.) Brückn. loc. cit. 1927; loc. cit. 1930.

Tripogandra **elongata** (G. F. W. Meyer) Woodson, comb. nov.
Tradescantia elongata G. F. W. Meyer, Fl. Esseq. 146. 1818; C. B. Clarke, loc. cit. 303. 1881.
Descantaria elongata (G. F. W. Meyer) Brückn. loc. cit. 1927; loc. cit. 1930.

Tripogandra **floribunda** (Hook. & Arn.) Woodson, comb. nov.
Aneilema floribunda Hook. & Arn. Bot. Beechey Voy. 311. 1840.
Tradescantia filiformis Mart. & Gal. Bull. Acad. Brux. **9**^{2}: 276. 1842.
Leptorhoeo filiformis (Mart. & Gal.) C. B. Clarke in Hemsl. Diagn. Pl. Nov. 55. 1880; C. B. Clarke, loc. cit. 317. 1881; Brückn. loc. cit. 167. 1930.
Leptorhoeo floribunda (Hook. & Arn.) Baill. Hist. Pl. **13**: 218. 1894.

Three errors are widespread in citing this species under *Leptorhoeo,* including two variants in spelling the generic name *(Leptorrhoeo, Leptorhoës),* and the combination itself is frequently accredited to Hemsley (even the citation of Clarke himself in DC. Monogr.).

TRIPOGANDRA **grandiflora** (Donn. Sm.) Woodson, comb. nov.
Callisia grandiflora Donn. Sm. Bot. Gaz. **31**: 125. 1901.
Donnellia grandiflora (Donn. Sm.) Clarke, Bot. Gaz. **33**: 261. 1902.
Neodonnellia grandiflora (Donn. Sm.) Rose, Proc. Biol. Soc. Wash. **19**: 96. 1906; Brückn. loc. cit. 174. 1930.

TRIPOGANDRA **Lundellii** (Standl.) Woodson, comb. nov.
Tradescantia Lundellii Standl. Field Mus. Publ. Bot. **22**: 5. 1940.

TRIPOGANDRA **minuta** (C. B. Clarke) Woodson, comb. nov.
Tradescantia minuta C. B. Clarke, loc. cit. 307. 1881.
Descantaria minuta (C. B. Clarke) Brückn. loc. cit. 56: 1927; Brückn. in Engl. & Prantl, loc. cit. 171. 1930.

TRIPOGANDRA MULTIFLORA (Sw.) Raf. loc. cit. 16. 1836 [1837].
Tradescantia multiflora Sw. Prodr. 57. 1789; C. B. Clarke, loc. cit. 305. 1881.
Tradescantia procumbens Willd. Sp. Pl. **2**[1]: 19. 1800.
Heminema multiflora (Sw.) Raf. loc. cit. 17. 1836 [1837].
Descantaria procumbens (Willd.) Hassk. ex C. B. Clarke, loc. cit. 1881, nom. nud. in synon.
Descantaria multiflora (Sw.) Brückn. loc. cit. 56. 1927; Brückn. in Engl. & Prantl, loc. cit. 172. 1930.

TRIPOGANDRA **Palmeri** (Rose) Woodson, comb. nov.
Tradescantia Palmeri Rose, Contr. U. S. Nat. Herb. **1**: 113. 1891.
Descantaria Palmeri (Rose) Brückn. loc. cit. 56. 1927.

TRIPOGANDRA **rosea** (Vent.) Woodson, comb. nov.
Tradescantia rosea Vent. Jard. Cels. *pl. 24.* 1800; Anders. & Woods. loc. cit. 112. 1935; C. B. Clarke, loc. cit. 298. 1881; Brückn. loc. cit. 167. 1930.
Cuthbertia rosea (Vent.) Small. Fl. Southeast. U. S. 237. 1903.

I am not making adjustments under *Tripogandra* for the two varieties which Anderson and I recognized under *T. rosea* in our

earlier revision (loc. cit. 1935), as I am not certain whether they should be interpreted as varieties or species. This is a question that can be settled only by extensive field study.

TRIPOGANDRA **saxicola** (Greenm.) Woodson, comb. nov.

Tradescantia saxicola Greenm. Proc. Amer. Acad. **39**: 70. 1903.

Descantaria saxicola (Greenm.) Brückn. loc. cit. 56. 1927.

TRIPOGANDRA **Warscewicziana** (Kunth & Bouché) Woodson, comb. nov.

Tradescantia Warscewicziana Kunth & Bouché, Ind. Sem. Hort. Berol. **11**: 1847; C. B. Clarke, loc. cit. 302. 1881.

Spironema Warscewiczianum Hassk. ex. C. B. Clarke, loc. cit. 1881, nom. nud. in synon.

Spironema Warscewiczianum (Kunth & Bouché) Brückn. loc. cit. 171. 1930.

IX. CALLISIA L. in Loefl. It. Hisp. 305. 1758; C. B. Clarke, loc. cit. 309. 1881; Brückn. loc. cit. 173. 1930.

Hapalanthus Jacq. Select. Stirp. Amer. 11. *pl. 11.* 1763.

Spironema Lindl. Edwards's Bot. Reg. N. S. **3**: *pl. 47,* Miscel. 26. 1840; C. B. Clarke, loc. cit. 313. 1881; Brückn. loc. cit. 171. 1930.

Tradescantella Small. loc. cit. 238. 1903.

Rectanthera Degener, Fl. Hawai. **1**: 62. 1932.

CALLISIA **fragrans** (Lindl.) Woodson, comb. nov.

Spironema fragrans Lindl. loc. cit. 1840; C. B. Clarke, loc. cit. 1881; Brückn. loc. cit. 1930.

Rectanthera fragrans (Lindl.) Degener, Fl. Hawai. **1**: 62. 1932.

Aside from its gigantic size, the relationship of this species to the small creeping plants of *Callisia* should be sufficiently clear. The long runners by which *C. fragrans* propagates vegetatively probably are related phylogenetically to the creeping stems of the latter.

The remaining genera require little comment, as my views coincide with current interpretations of them. These studies still leave *Tradescantia* a large and rather complicated genus, although not as much so as formerly. Future studies may well restrict the genus even further, devoting particular attention to such tropical and subtropical groups as *T. micrantha* Torr., *T. commelinoides* R. & S. and their relatives, and the *T. fluminensis* Vell. complex.

A REVISION OF THE GENUS BUMELIA IN THE UNITED STATES[1]

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The genus *Bumelia* is the hardiest representative of the Sapotaceae in North America, occurring as far north as the lower valley of the Missouri River. It therefore differs from other members of this tropical and subtropical family in its adaptation to a temperate climate. The majority of species grow in mesophytic situations, although certain species have become well established in xerophytic habitats.

General Morphology

Bumelia is distinguished morphologically from other genera of the Sapotaceae in the structure of the flower and fruit, for example: (a) a pair of lateral appendages flank each corolla-lobe, (b) staminodia replace a cycle of stamens, and (c) the seeds are without albumen and exhibit a circular, basal hilum.[2]

Stem: The stems are sometimes armed with simple or branched spines. The bark is reddish-brown, appearing gray in age, while the branchlets in certain species are somewhat pubescent. The wood is singularly tough, becoming brittle in *B. angustifolia,* invariably yellowish, and very close-grained.[3] "Short-shoots," or brachyblasts, suggestive of certain gymnosperms, are frequently found in the leaf axils.

Corolla: The genus is characterized in part by the structure of its corolla, which is sympetalous through basal coalescence of the whitish petals to form a short tube. Each corolla-lobe bears a pair of lateral, petaloid appendages, thus constituting a pentamerous corolla with trifid lobes.[4]

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[1] An investigation carried out in the Graduate Laboratories of the Henry Shaw School of Botany of Washington University and submitted as a thesis in partial fulfillment of the requirements for the degree of master of science in the Henry Shaw School of Botany of Washington University.

[2] Baehni, C., in Candollea 7: 424. 1938.

[3] Record, S. J., in Trop. Woods 59: 26–27. 1939.

[4] A completely satisfactory evaluation of the various components of the flower of *Bumelia*, especially the lateral appendages of the corolla-lobes, has not become established. Students of the Sapotaceae have merely suggested the probable origin and relationship of the appendages: Hartog, M. M., On the floral structure and affinities of Sapotaceae. Jour. Bot. 16: 66. 1878; Lam, H. J., On the system of the Sapotaceae. Recueil Trav. Bot. Neerland. 36: 519. 1939.

Issued September 18, 1942.

Androecium: The five fertile stamens are epipetalous and opposite the lobes of the corolla. The anthers are attached to slender filaments and dehisce extrorsely by means of longitudinal slits. The staminodia, alternating with the fertile stamens, are petaloid and at an early phase of anthesis form a tube through which the filiform style emerges while the rapidly maturing stamens are enclosed by the yet unexpanded corolla.

Gynoecium: The pistil is pentacarpellary. The superior ovary bears a simple, erect, relatively short style surmounted by an inconspicuous stigma that becomes receptive before the corolla is completely unfolded. Normally, the outer wall of the ovary is hirsute, but this character is not constant throughout the genus, e. g., *B. reclinata.* Although the ovary bears five anatropous ovules (one in each locule), it is seldom that more than one develops.

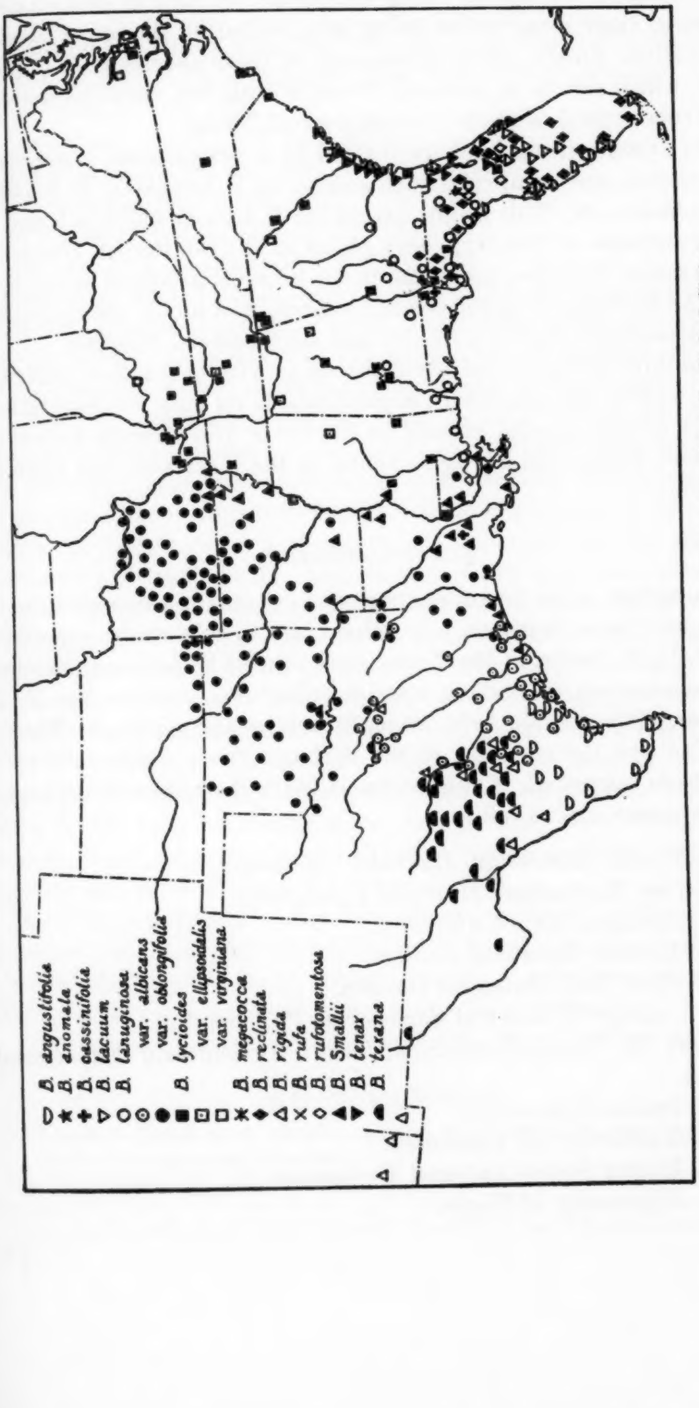
Fruit: The fruit is a single-seeded berry, enclosed in the fleshy wall of the ovary and often tipped by the persistent style. The berries are rather small, generally purplish-black when ripe, and edible.

Seed: The seeds are small with a hard, shiny, and oily testa which is generally brown though sometimes becoming variegated. The embryo is large, filling the cavity, while the radicle is barely evident; the cotyledons are thick, fleshy, usually consolidated, and albumen is wanting.

Geographical Distribution

Bumelia proves to be not only the hardiest genus of the Sapotaceae but also the most extensive. It ranges from the southeastern section of the country as far north as central Missouri and as far west as southeastern Arizona. The region of greatest diversity of species is centered in Florida, where eleven species occur, five being endemic. The greatest diversity of habitat is in Texas, where one species may be found growing in moist woodlands, while another inhabits only dry, sandy situations.

There are three natural groups of *Bumelia* in the United States. The first group consists of those species with lanuginose or sericeous pubescence on the branchlets, the under-surface of the leaves, the petioles, and the inflorescence, and includes *B. lanuginosa, B. tenax, B. lacuum, B. rigida,* etc. Except for the xerophytic species *B. rigida,* which occurs from southern Texas to southeastern Arizona, members of this group are chiefly mesophytic and inhabit sandy uplands, though not far removed from a source of water.



Map showing distribution of species of *Bumelia* throughout the United States.

They range from coastal South Carolina westward to southeastern Arizona, their distribution being interrupted by the lower Mississippi River Valley. Most widespread of these species is *B. lanuginosa,* which occurs in southern Georgia with two varieties extending from central Missouri to east-central Texas.

The second group is characterized by a tomentulose evanescent pubescence, and comprises such species as *B. lycioides, B. Smallii, B. reclinata,* etc. This group, except for *B. texana* which is found in the mountains or the dry, rocky plains of the Southwest, frequents more moist localities, occurring in the lower Mississippi River Valley, the Gulf and Atlantic coastal regions, and along water-courses as far north as southern Illinois and southeastern Virginia.

The third group is entirely glabrous or with only a few scattered hairs, and in this country *B. angustifolia* is its only representative. Plants of this species abound in the lower Rio Grande Valley of southern Texas, and are again found on the Keys and Gulf coast of Florida.

Acknowledgments

The writer takes this opportunity to express his appreciation to those who have so generously helped him in this study, especially to Mr. H. B. Parks, of the Texas Agricultural Experiment Station, for cooperation in making special collections, and to Mr. E. J. Palmer, of the Arnold Arboretum, for advice and criticism. Thanks are also due the curators of the herbaria from which specimens have been borrowed. These herbaria, with the abbreviations used in this paper, are as follows:

A—Arnold Arboretum, Harvard University.
G—Gray Herbarium, Harvard University.
L—Louisiana State University.
M—Missouri Botanical Garden.
NY—New York Botanical Garden.
P—Academy of Natural Sciences of Philadelphia.
Tr—S. M. Tracy Herbarium, Texas Agricultural Experiment Station.
Tu—Tulane University.
UO—University of Oklahoma.
US—United States National Herbarium.
UT—University of Texas.

Taxonomy

Bumelia[5] Sw. Prodr. Veg. Ind. Occ. 49. 1788; Benth. & Hook. Gen. Pl. **2**: 660. 1876; Engler & Prantl, Nat. Pflanzenfam. **4**[1]: 145. 1891; Sarg. Silva **5**: 167. 1893.

Lycioides L. Hort. Cliff. 488. 1738.

Robertia Scop. Introd. Hist. Nat. 154. 1777.

Sclerocladus Raf. Sylva Tellur. 35. 1838.

Sclerozus Raf. Aut. Bot. 2: 73. 1840.

Lyciodes O. Ktze. Rev. Gen. **2**: 406. 1891.

Shrubs or small trees frequently with milky sap and spinescent branches. Leaves alternate or often fasciculate, simple, obovate to elliptic, entire, penninerved, short-petiolate, pubescent or glabrous beneath, usually coriaceous, deciduous or persistent. Flowers small, on rather short pedicels from the axils of scarious bracts, in many-flowered clusters from leaf-axils or from leafless nodes of the previous year, hermaphrodite, pentamerous, actinomorphic, hypogynous, proterogynous; calyx with 5 dimorphic, free sepals which are imbricate in aestivation and decurrent on the pedicel, persistent; corolla whitish, sympetalous, forming a short tube, the 5 lobes with pairs of lateral appendages; stamens epipetalous, 10 in 2 isomerous whorls—the fertile cycle opposite and equal in length to the corolla-lobes, the alternipetalous one reduced to petaloid staminodia; ovary 5-celled, generally hirsute, gradually or abruptly contracted into a filiform style stigmatic at apex, each locule with a solitary, anatropous ovule from the base of an axile placenta. Fruit a berry, oblong-ellipsoid or subglobose, blackish, often tipped by a persistent style; seed solitary with crustaceous, smooth, shiny, brownish testa, without albumen; embryo large, filling the cavity; cotyledons thick and fleshy.

Bumelia is confined to the New World, where it is distributed from central United States southward to Mexico, Central America, the West Indies, and South America as far as northern Argentina. Of the 35–40 species, 14 are found in the United States.

TYPE SPECIES: *Bumelia retusa* Sw. Prodr. Veg. Ind. Occ. 49. 1788.

Key to the Species

A. Branchlets (except in *B. anomala*), petioles, lower surface of leaves, and inflorescence conspicuously pubescent.

B. Pubescence woolly and lusterless.

[5] Internat. Bot. Kongr. in Wien, Verhandl. No. 6374 in list of Nomina Conservanda. Jena, 1906.

C. Leaves 2–10 cm. long, 1–4 cm. broad; flowers rather numerous.
D. Pubescence dense, rusty-tomentose; pedicels slender; seed oblong-obovoid, variegated..*1. B. lanuginosa*
DD. Pubescence dense, whitish-tomentose; pedicels slender; seed ellipsoid, brown..*1a.* var. *albicans*
DDD. Pubescence sparser than in species, whitish becoming tawny; pedicels stoutish; seed obovoid, brown......................*1b.* var. *oblongifolia*
CC. Leaves 1–4 cm. long, 0.5–1.5 cm. broad; flowers few..............*2. B. rigida*
BB. Pubescence sericeous and shiny.
C. Branches stout and spiny; leaves often small, not more than 4 cm. long; pubescence rufous.
D. Branchlets and lower surface of leaves densely tomentose; fruit obovoid, 8–10 mm. long.....................................*3. B. lacuum*
DD. Branchlets densely tomentose, lower surface of leaves hairy only on midrib and veins; fruit subglobose, 4–6 mm. long......*4. B. rufotomentosa*
CC. Branches slender and nearly spineless; leaves rather large, usually more than 4 cm. long; pubescence silvery-white to tawny.
D. Leaves oblong-obovate to oblanceolate, cuneate at base; pedicels extremely slender, 8–13 mm. long.............................*5. B. tenax*
DD. Leaves oblong-obovate to elliptic, obtuse at base; pedicels stout, 3–5 mm. long.
E. Branchlets glabrous, pale yellowish-gray; leaves shiny and pale green above, silvery beneath.................................*6. B. anomala*
EE. Branchlets very tomentose, red or reddish-brown; leaves dull and dark green above, tawny beneath..........................*7. B. rufa*
AA. Branchlets, petioles, lower surface of leaves, and inflorescence with few inconspicuous hairs generally scattered along midrib; or entirely glabrous.
B. Leaves puberulous or glabrate; fruit obovoid or subglobose (except in *B. lycioides* var. *ellipsoidalis*).
C. Leaves elliptic, generally broadest at middle.
D. Leaves 1.5–13.5 cm. long, obtuse to acuminate at apex (except var. *virginiana*)..*8. B. lycioides*
E. Leaves rounded at apex; corolla-tube shorter than in species; fruit obovoid..*8a.* var. *virginiana*
EE. Leaves acute to acuminate at apex; corolla-tube same length as in species; fruit ellipsoid...........................*8b.* var. *ellipsoidalis*
DD. Leaves 2–5 cm. long, acute to occasionally rounded at apex.....*9. B. Smallii*
CC. Leaves obovate or spatulate, mainly broadest above middle.
D. Leaves thinnish; corolla-lobes erose; seed usually not variegated.
E. Fruit 4–6 mm. long; seed occasionally variegated; ovary glabrous ....*10. B. reclinata*
EE. Fruit 8–12 mm. long; seed not variegated; ovary hirsute.......... ....*11. B. cassinifolia*
DD. Leaves coriaceous; corolla-lobes entire; seed variegated.
E. Leaves 1–7 cm. long; fruit obovoid, 8–10 mm. long......*12. B. texana*
EE. Leaves 1–3.5 cm. long; fruit subglobose, 10–13 mm. long.......... ....*13. B. megacocca*
BB. Leaves glabrous; fruit ellipsoid-cylindrical...................*14. B. angustifolia*

1. **Bumelia lanuginosa** (Michx.) Pers. Syn. **1**: 237. 1805; DC. Prodr. **8**: 190. 1844; Nutt. Sylva **3**: 36. 1849; Sarg. Silva **5**: 171, *pl. 247*. 1893, *pro parte*.

Sideroxylon tenax Walt. Fl. Car. 100. 1788, non L.
Sideroxylon lanuginosum Michx. Fl. Bor. Am. **1**: 122. 1803.
? *Chrysophyllum ludovicianum* Raf. Fl. Ludovic. 53. 1817.
Lyciodes lanuginosum O. Ktz. Rev. Gen. **2**: 406. 1891.

Shrub or small tree, 3–7 m. high; branchlets, petioles, lower surface of leaves, and inflorescence covered with lusterless tomentum at first pale, becoming reddish-brown; stems with reddish-gray bark, armed occasionally with short stout spines; leaves narrowly oblong-obovate, rarely elliptic, 2–10 cm. long, 1–4 cm. broad, round to acute or sometimes mucronate at apex, cuneate at base, dark green and lustrous above, thin and firm at maturity; petioles 2–15 mm. long; flowers disposed in few- to many-flowered fascicles; pedicels 8–12 mm. long, greatly enlarged towards apex; sepals broadly obovate to suborbicular, rounded at apex; corolla-lobes broadly ovate to elliptic, appendages ovate-lanceolate, acute; staminodia ovate-elliptic, obtuse at apex, erose, nearly as long as the petals; fruit purplish-black, oblong-ellipsoid, 6–10 mm. long, frequently tipped by a persistent style; seed oblong-obovoid, 5–8 mm. long, variegated tan and brown.

Distribution: in sandy uplands and along streams, southwestern Georgia and adjacent Florida, westward to southeastern Louisiana.

Specimens examined:

GEORGIA: precise data lacking, *Michaux s.n.* (Mus. Paris, TYPE; G, fragment). DECATUR Co.: near Bainbridge: *Curtiss 1762*, in part (A), *Harbison 15, 1127* (A). DOUGHERTY Co.: along Flint R. at Albany: May 24-28, 1895, *Small* (A), *Harbison 14* (A); Dr. Gillespie's Pocoson Place, *Gillespie 4956* (A). RANDOLPH Co.: Cuthbert, *Harbison 6* (A). TELFAIR Co.: Lumber City, *Harbison 16* (A). TERRELL Co.: banks of Kinckafoonee Cr., *Harper 1153* (G, M).

FLORIDA: exact locality unknown, *Chapman* (G, M, P); "N.W. Fla.", *Curtiss 35* (G). ALACHUA Co.: Gainesville, *Seibert 1412, 1412a* (M). COLUMBIA Co.: Lake City: *Nash 2167* (A, G, M), *Wiegand & Manning 2486* (G). DIXIE Co.: Old Town, *Harbison 12* (A). FRANKLIN Co.: banks of Chattahoochee R., above Apalachicola: *Biltmore Hb. 1688*, coll. by Chapman (A, G, M), *Saurman* (P); Carrabelle, *Harbison 23, 27* (A). JACKSON Co.: Marianna: *Harbison 14, 29* (A), *Palmer 35301* (A, M, P). LEVY Co.: Cedar Keys, *Tracy 7464* (A, G, M). WAKULLA Co.: Wakulla Springs, *Harbison 1216* (A, M). TAYLOR Co.: Hampton Springs, *Palmer 38474* (A, M).

ALABAMA: locality not given: *Beck* (P), *Cabell* (G). BALDWIN Co.: Fairhope, *Jack 3026* (A); Perdido, *Mohr 47* (A). DALE Co.: near Ozark, *Palmer 38653* (A, M). DALLAS Co.: Selma, *Harbison 96, 829, 1095, 1111* (A). MOBILE Co.: Mt. Vernon, *Harbison 7* (A).

MISSISSIPPI: HARRISON Co.: Mississippi City, *Harbison 3* (A); Stabilized Beach, Cat Isl., Apr. 19, 1931, *Penfound* (Tu).

LOUISIANA: ST. TAMMANY Parish: Slidell, Aug. 1899, *Cocks* (A).

B. lanuginosa is limited in its distribution; it seems to be related to *B. tenax* but is distinguished by its sparser, woolly pubescence

(which in *B. tenax* is sericeous), its generally larger and broader leaves, and its fewer-flowered inflorescence.

1a. Bumelia lanuginosa var. **albicans** Sarg. in Jour. Arn. Arb. **2**: 168. 1922.

Bumelia arborea Buckl. in Proc. Phil. Acad. **13**: 461. 1861.

Small tree to 20 m. high, with branches rarely armed; pubescence dense, whitish, lusterless, appressed at first, becoming woolly; leaves somewhat narrower than in species; petioles 5–15 mm. long; inflorescence many-flowered; pedicels slender, 5–13 mm. long; sepals reniform to elliptic; corolla-lobes oblong-elliptic; margins of appendages crenulate; staminodia oblong-elliptic, rounded and somewhat cucullate at apex; ovary subglobose, abruptly contracted into an elongated style; fruit ellipsoid to oblong-obovoid, 8–12 mm. long; seed ellipsoid, brown with tuberculate apex.

Distribution: in sandy river-bottoms and rocky uplands, east-central Texas, and adjacent Mexico.

Specimens examined:

TEXAS: "S. Tex.", *Buckley* (P, type of *B. arborea*, G, fragment). ATASCOSA CO.: s. of San Antonio on road to Corpus Christi, *Buckley* (A); Campbelton, *Palmer 11242* (M). BEXAR CO.: San Antonio: *Bush 802* (A, M), Hildebrandt Rd., *Clark & Parks 567* (M); Swearingen Ranch, *Schulz 49* (A). BOSQUE CO.: Meridian, June 29, 1927, *Tharp* (UT). BRAZORIA CO.: Brazos R., Brazoria, *Palmer 6741* (A, M); Columbia: *Bush 1, 2, 3, 210, 226, 877, 1427, 1524* (M), *Palmer 5050* (A); Velasco, *Palmer 13131* (A, M). BRAZOS CO.: Bryan, *Palmer 11739* (A, M); near Neleva, *Palmer 13446* (A, M). CALHOUN CO.: Indianola, *Cory 11618* (A); Wolf Pt., *Tharp 1431* (UT). CHAMBERS CO.: Apr. 8, 1936, *Tharp* (UT). COMAL CO.: Brazos R. bottoms, *Lindheimer 90* (M); New Braunfels, *Lindheimer 269*, in distribution as no. *979* (A, G, M, P, UO, UT). DALLAS CO.: Dallas: *Reverchon 384* (G), *590* (A, M), June 22, 1899, *Eggert* (M), Nov. 21, 1913, *Sudworth* (A). ERATH CO.: Stephenville, *Palmer 14176* (A, M). FT. BEND CO.: Brazos R., Richmond, *Palmer 4943* (A). GALVESTON CO.: Galveston Isl., May 1843, *Lindheimer* (M). GOLIAD CO.: Goliad: Apr. 8, 1900, *Eggert* (M), along San Antonio R., near La Bahia Mission, *Clark & Parks 574* (M). GONZALES CO.: Halff Ranch, Mar. 3, 1940, *Parks* (Tr); Ottine Swamp, *Cory 5770* (A). HARRIS CO.: Houston: June 1842, Aug. 1843, *Lindheimer* (M), June 16, 1903, *Reverchon* (M), June 4, 1915, *Fisher* (M), *Palmer 11456* (A, M). JACKSON CO.: E. Karankawa Pt., *Tharp 1424* (UT). LAMPASOS CO.: Lampasos, Mar. 21, 1911, *Sargent* (A). LLANO CO.: Enchanted Rock, June 11, 1930, *Tharp* (UT). MATAGORDA CO.: Peyton's Cr., *Palmer 9734* (A, M). NAVARRO CO.: Corsicana, *Reverchon 3194* (M); near Dawson, *Reverchon 3867* (M). NUECES CO.: Nuecestown, Apr. 27, 1896, *Marlatt* (US). PALO PINTO CO.: Strawn, *Palmer 14266* (A, M). RUSK CO.: Henderson, July 30, 1927, *Tharp* (UT). SAN SABA CO.: San Saba, *Palmer 11844* (A). SOMERVILLE CO.: Squaw Cr., above Glen Rose, Oct. 9, 1891, *Ward* (US). TARRANT CO.: Caddo Cr. bottoms, near Handley, Sept. 23, 1902, *Reverchon* (M); near Ft. Worth, *Ruth 202* (G, M, P). TRAVIS CO.: Austin: Apr. 1860, *Buckley* (M), *Mohr 12* (A), *Mohr 623* (US), Mar. 29, 1885, *Sargent* (A), *Schostag 3002* (UT), *McKee & Wesley 3834* (UT), *Parker 4791* (UT), *N. Y. State College of Forestry, Proj. I, 8269*, coll. by Tharp (A), *Schulz 2434* (A). VICTORIA CO.: Guadalupe R. bottoms, Victoria: Apr. 9, 1915, *Sargent* (A, TYPE), *Palmer 9104* (A, M).

WALKER Co.: Huntsville, *Dixon 403* (G). WALLER Co.: Hempstead, *Hall 394* (G, M). WHARTON Co.: banks of Colorado R., Wharton, *Palmer 4902* (A). WILSON Co.: *Parks & Cory 7791* (Tr); Sutherland Springs: Oct. 1910, *Mackenson* (A), Apr. 8, 1915, *Sargent* (A), *Palmer 9209* (A, M), *Cutler 858* (M).

MEXICO: NUEVO LEON: near Monterrey, Apr. 6, 1887, *Sargent* (A).

Tallest of the Bumelias in the United States, *B. lanuginosa* var. *albicans* is limited in distribution and is easily recognized by its rather dense, whitish pubescence.

1b. Bumelia lanuginosa var. **oblongifolia** (Nutt.) Clark, comb. nov.

Bumelia oblongifolia Nutt. Gen. **1**: 135. 1818; Sylva **3**: 33. 1849.
Bumelia arachnoidea Raf. New Fl. N. Am. 3: 28. 1836.
Bumelia tomentosa A. DC. in DC. Prodr. **8**: 190. 1844.

Armed shrub or small tree; pubescence rather sparse, dull, whitish, becoming tawny; leaves obtuse to rounded or somewhat retuse at apex, broadly cuneate at base; petioles 2–10 mm. long; flowers numerous; pedicels 5–8 mm. long; sepals suborbicular to oblong-ovate or elliptic; corolla-lobes oblong-ovate; ovary subglobose, abruptly contracted into the style; fruit broadly elliptic-ovate; seed obovoid, brown.

Distribution: in dry, rocky uplands, southern Missouri and southeastern Kansas to Louisiana and eastern Texas.

Specimens examined:

MISSOURI: BARRY Co.: Eagle Rock: *Bush 182, 3130* (M); Roaring R., *Trelease 1117* (M). BENTON Co.: along Cole Camp Cr.: *Demetrio 47* (G), *Trelease 430* (M), *Palmer 30067* (A, M); along Osage R.: near Fredonia, *Palmer 35956* (A, M), near Warsaw, *Palmer 36769* (A, M). BOONE Co.: Missouri R. bluffs above Wilton P. O., *Jeffrey 307* (M). CALLAWAY Co.: along Stinson Cr., s.w. of Fulton, *Steyermark 26076* (M). CARTER Co.: Club House, *Trelease 427* (M); along Big Barren Cr., s.e. of Fremont, *Steyermark 11888* (M). CEDAR Co.: along Sac R., n.e. of Stockton, *Steyermark 13479* (M). CHRISTIAN Co.: Swan Cr., s.e. of Chadwick, *Steyermark 22991* (M). COLE Co.: near Brazito, *Palmer 39227* (A, M); near Jefferson City, *Palmer 39231* (A). COOPER Co.: *Bush 13654, 13893* (A). DADE Co.: near Turnback, *Palmer 35595* (A, M). DALLAS Co.: along Niangua R., s. of Windyville, *Steyermark 13737* (M). DOUGLAS Co.: between Roosevelt and Richville, *Steyermark 14693* (M). FRANKLIN Co.: July-Aug. 1835, *Meyer* (M); Catawissa, July 26, 1887, *Eggert* (G, M); Pacific, *Greenman 3898* (M); along Meramec R., Meramec State Pk., Sullivan, *Steyermark 1492* (M). GREENE Co.: near Springfield, *Palmer 30148* (A, M). HENRY Co.: along Grand R., n.e. of Finey, *Steyermark 15964* (M). HICKORY Co.: along Pomme de Terre R., near Hermitage, *Palmer 35983* (A, M). IRON Co.: near Ironton, *Palmer 22642* (A). JASPER Co.: Carterville, *Palmer 2655, 18318* (A); Carthage, *Bush 10390* (A, G, M); Muddy Cr., Golden City, *Palmer 4585* (A, M); near Jasper, *Palmer 28931* (A, M); near Joplin: *Trelease 433* (M), *Palmer 22730, 23366, 26316* (A); Neck, *Palmer 15723* (A); Spring R., *Trelease 1116* (M); near Waco, *Palmer 18483* (A); Webb City, *Palmer 28, 927, 14291* (M). JEFFERSON Co.: De Soto, July 25, 1887, *Hasse* (M); s.e. of Pacific, *Steyermark 1270* (M); Victoria, May 10 and July 8, 1890, *Hitchcock* (M).

LAWRENCE Co.: near Red Oak, *Palmer 26980* (A, M). MADISON Co.: near Fredericktown, *Palmer 31622, 31639* (A). MARIES Co.: Lanes Prairie, *Bush 13470* (A). MCDONALD Co.: *Bush 236* (G, M); Noel: *Bush 4978, Palmer 4264, 5491, 14660, 14664* (A, M). MILLER Co.: Bagnell, *Trelease 426* (M); near Tuscumbia, *Palmer 39220* (A, M). MONITEAU Co.: between California and Jamestown, *Steyermark 14758* (M). MORGAN Co.: *Bush 13596, 13691* (A, M); along Proctor Cr., *Steyermark 13181* (M). OSAGE Co.: along Maries R., w. of Westphalia, July 14, 1933, *Jeffrey* (A). OZARK Co.: near Bakersfield, *Palmer 32819* (A, M); "Bald Jesse" near Gainesville, *Palmer 34761* (A, M). PETTIS Co.: *Bush 13628* (A, M). PHELPS Co.: "Slaughter Sink" near Arlington, *Palmer & Steyermark 41399* (A, M); Jerome, *Kellogg 388* (A, M). POLK Co.: along Pomme de Terre R.: n. of Burns, *Steyermark 13630* (M), Buzzards Den, n.w. of Pleasant Hope, *Steyermark 24108* (M). PULASKI Co.: Big Piney R., *Trelease 429* (M). RIPLEY Co.: Bay Mills, *Mackenzie 392* (M). ST. CHARLES Co.: Meramec R. at St. Pauls, 25 mi. w. of St. Louis, Nov. 2, 1854, *Engelmann* (G, M). ST. CLAIR Co.: along Osage R.: near Osceola, *Palmer 35646* (A, M, P), n. of Oyer, *Steyermark 20237* (M). ST. FRANCOIS Co.: Bismarck, *Palmer 18055* (A, M); Flat River, *Trelease 431, 432* (M). ST. LOUIS Co.: July 26, 1886, *Eggert* (A, US); Allenton: 1876–1911, *Letterman* (M, P, US), July 29, 1887, *Eggert* (M); Big Bend, Meramec R., *ex Glatfelter Hb. 308* (M); near Glencoe and Valley Park, July 18, 1879, *Eggert* (M); Meramec Highlands: 1874, *Letterman* (M), July 28 and Sept. 6, 1886, *Eggert* (M, UT), June 25, 1904, *Gleason* (G), *Bartram 2425* (P); Pleasant Grove, *Bush 262* (M). SHANNON Co.: *Bush 956* (M); Montier: *Bush 171, 704, 1138* (M), *Palmer 19390* (A, M). STODDARD Co.: n. of Puxico, *Steyermark 11641* (M). STONE Co.: near Galena: *Palmer 4641, 5772, 5860, 5862, 14360, 22860, 24601, 26136* (A); "White Rock Bluff," White R., *Palmer 5857* (A, M). TANEY Co.: Swan Cr., *Trelease 428* (M). WASHINGTON Co.: near Irondale, *Palmer 30172* (A, M). WAYNE Co.: Williamsville, *Palmer 6113* (A, M). WEBSTER Co.: headwaters of James R., *Engelmann 53* (M); near Niangua, *Palmer 39504* (A, M, P). WRIGHT Co.: *Bush 905* (M).

ARKANSAS: complete data lacking, *Nuttall s.n.* (P, TYPE), June 7, 1854, *Beyrich* (M). BENTON Co.: Twin Mt. and Osage R., *Demaree 4563, 4614* (M); near Monte Ne, *Palmer 24749* (A, M). BOONE Co.: Harrison, *Palmer 6917* (A). CARROLL Co.: Beaver, *Palmer 6330* (A, M); near Eureka Springs, *Palmer 20472* (A). CLARK Co.: Amity, *Demaree 10017* (M); Arkadelphia, *Palmer 10536* (A); Okolona, *Demaree 16100* (M). DREW Co.: Tillar, *Demaree 19281* (M). FAULKNER Co.: *Demaree 99* (M); Mammoth Springs, *Demaree 5294* (M). GARLAND Co.: near Hot Springs, *Palmer 23083, 29075* (A, M). HOT SPRINGS Co.: Magnet Cave, *Palmer 26565* (A). IZARD Co.: along White R., near Calico Rock, *Palmer 35553* (A, M). JACKSON Co.: Newport: May 5, 1881, *Letterman* (A, M), *Palmer 35533* (A, M). LOGAN Co.: Magazine Mt., *Palmer 24165* (A, M). MARION Co.: bluffs of White R., Cotter, *Palmer 5915, 14328* (M). MONTGOMERY Co.: bottoms of Caddo Cr., Norman, *Demaree 9561* (M). POPE Co.: near Nogo, *Merrill 88* (A, M, NY). PULASKI Co.: Little Rock: 1880, *Harvey* (M), banks of Arkansas R., *Palmer 22929* (A, M); Palarm, *Demaree 8716* (A); Maumelle Mt., Pinnacle, *Palmer 23015* (A). SALINE Co.: banks of Saline R., near Benton, *Demaree 8496* (A). SEVIER Co.: Horatio, *Palmer 8389* (A, M). VAN BUREN Co.: near Shirley, *Palmer 24314* (A, M).

LOUISIANA: exact locality lacking, *Hale* (G, P). CADDO Parish: Shreveport, July 1909, *Dickson* (Tu). CALCASIEU Parish: Lake Charles: Apr. 13, 1915, *Sargent* (A), *Palmer 7699* (A, M). CAMERON Parish: Cameron, *Palmer 8536* (A, M). LA SALLE Parish: Standard, Sept. 1, 1927, *Whitehead* (L). NATCHITOCHES Parish: Natchitoches, *Palmer 7468, 8022, 8763* (A, M). ORLEANS Parish: New Orleans, 1832, *Drummond 207*, in part (G, cotype of *B. tomentosa*). TANGIPAHOA Parish: Hammond, May 1910, *Cocks* (Tu). VERNON Parish: Leesville, *Brown 6869, 6872* (L).

KANSAS: CHAUTAUQUA Co.: along Middle Caney Cr., near Sedan, *Palmer 41809* (A, M). CHEROKEE Co.: *Black 757* (G, M); near Galena, *Palmer 20884, 21982, 25339* (A). COWLEY

Co.: Arkansas City, *Palmer 21244, 22072* (A). CRAWFORD Co.: near Pittsburg, *Palmer 20826* (A). LA BETTE Co.: w. of Oswego, *Rydberg & Imler 317* (M). NEOSHO Co.: Ladore, Nov. 15, 1893, *Hart* (P). WILSON Co.: near Neodesha, *Palmer 21160, 22030* (A).

OKLAHOMA: BLAINE Co.: Canton, *Andrews 20* (A). CANADIAN Co.: Devils Canyon, e. of Hinton: *Little 3911* (A, UO), *Hopkins 2108* (UO). CHEROKEE Co.: e. of Tahlequah, *Little 477* (UO). CHOCTAW Co.: Ft. Towson, *Palmer 8308* (A, M). CLEVELAND Co.: near Norman: Aug. 20, 1924, *Braner* (A, US), *Felkner 11* (UO), *Stacy 107* (UO). COMANCHE Co.: Boulder Camp, Wichita Nat. Forest, *Demaree 13180* (UO). CUSTER Co.: Clinton, *Palmer 12559* (A, M). GARFIELD Co.: n.w. of Enid, *Brigham 11* (UO). GREER Co.: s.e. of Granite, *Bull 248* (UO). JOHNSON Co.: Tishomingo, *Palmer 6416* (A, M). KIOWA Co.: near Mountain Pk., *Stevens 1261½* (A, G). LE FLORE Co.: near Page: *Stevens 2628* (A, G), *Palmer 20556* (A); Poteau, *Palmer 8266, 8267* (A, M). MAJOR Co.: Cleo, *Stevens 1720* (G, M). MCCURTIN Co.: s. of Bethel, *Hopkins & Cross 2543* (UO). MCLAIN Co.: w. of Purcell, *Hopkins 1187* (UO). MURRAY Co.: Arbuckle Mts., *Hopkins 2750* (UO); Davis, *Emig 658* (M); Platte Nat. Pk., near Sulphur, *Merrill 908* (A), *1724* (M). MUSKOGEE Co.: Muskogee, *Palmer 11198* (A, M). OKLAHOMA Co.: Oklahoma City, *Palmer 14610, 22107* (A). OTTAWA Co.: Commerce, *Bush 9266, 10148* (A). PAYNE Co.: near Perkins, Oct. 3, 1896, *Bogue* (P); s.w. of Stillwater, *Spears 113* (UO). ROGER MILLS Co.: near Antelope Hills, *Bigelow 678* (G). TULSA Co.: along Arkansas R., *Bush 491* (A, G, M); near Fisher, *Stevens 2960-E* (G). WASHINGTON Co.: Copan, *Stevens 2154* (A, G). WOODS Co.: s.w. of Waynoka, *Jackson 340* (UO). WOODWARD Co.: near Woodward, *Palmer 41927* (A, M).

TEXAS: ANGELINA Co.: Pine Island, May 5, 1903, *Reverchon* (M); Jack Cr., July 25, and Haw Cr., Aug. 12, 1934, *Boon* (UT). ARCHER Co.: Diversion Lake, *Cory 13227* (A). BOWIE Co.: near Texarkana, *Heller & Heller 4242* (A, M, NY, US). GREGG Co.: n. of Longview, June 7, 1899, *Eggert* (M). DALLAS Co.: Dallas, *Bush 1619* (A, M). GRAYSON Co.: Denison, *Palmer 14273* (A, M). HARDEMAN Co.: n. of Chillicothe, *Parks & Cory 13368* (Tr), *Cory 13369* (A). HARRIS Co.: Houston, *Palmer 11927* (A, M). HARRISON Co.: Marshall, *Palmer 13226* (A, M). LLANO Co.: Enchanted Rock, Sept. 1, 1930, *Whitehouse* (UT). POLK Co.: Livingston, *Palmer 5262* (A, M). RUSK Co.: Tatum, Oct. 10, 1902, *Reverchon* (M). SAN AUGUSTINE Co.: San Augustine, *Palmer 7892, 7894* (A,M).

The most widespread element in the *B. lanuginosa* complex, var. *oblongifolia* differs from the species in its rather sparse pubescence and shorter pedicels.

2. **Bumelia rigida** (Gray) Small in Bull. N. Y. Bot. Gard. **1**: 444. 1900; Britt. N. Am. Trees, 780, *fig. 711.* 1908; Wooton & Standl. in Contrib. U. S. Nat. Herb. **19**: 495. 1915.

Bumelia spinosa S. Wats. in Proc. Am. Acad. **18**: 112. 1883, non A. DC.

Bumelia lanuginosa var. *rigida* Gray, Syn. Fl. N. Am., ed. 2, **2**[1]: 68. 1886.

Bumelia pauciflora Engelm. ex Gray, Syn. Fl. N. Am., ed. 2, **2**[1]: 68. 1886, non Roem. & Schult.

Armed shrub or small tree, 6–8 m. tall; branches numerous, short, spinescent, clothed in reddish or grayish bark; branchlets, lower surface of leaves, petioles, and inflorescence densely covered with

pale tomentum; leaves numerous, coriaceous, small, obovate to cuneate-oblanceolate, 1–4 cm. long, 0.5–1.5 cm. broad; flowers few; pedicels stout, 2–5 mm. long; sepals oblong-elliptic to suborbicular; corolla-lobes suborbicular, truncate at base, margins erose; appendages lanceolate to ovate-lanceolate, acute at apex, margins erose; staminodia ovate-lanceolate, obtuse at apex, margins erose; ovary cylindrical, abruptly contracted into a slender, elongated style; fruit obovoid to subglobose, 6–9 mm. long, purplish-black, short style often persistent; seed obovoid to subglobose, 3–6 mm. long, frequently narrowed at base, variegated, dark brown and pale tan.

Distribution: near streams on dry, gravelly mountain slopes, south-central Texas, westward to southeastern Arizona, and adjacent Mexico.

Specimens examined:

TEXAS: BEXAR Co.: San Antonio, *Clemens & Clemens 889* (M). DUVAL Co.: San Diego, Apr. 1882, *Buckley* (A). KERR Co.: Lacey's Ranch, *Schulz 36* (US). LLANO Co.: Harris, *Parks & Cory 6271* (Tr). NUECES Co.: Corpus Christi, Mar. 26, 1907, *York* (UT). UVALDE Co.: Uvalde, July 1879, *Edw. Palmer 156* (G, TYPE, US). VALVERDE Co.: Devils R., *Palmer 11367* (A, M).

NEW MEXICO: Dier Cr., June 20, 1906, *Wooton* (US); Dog Spring, Dog Mts., *Mearns 2351, 2356* (US); San Bernardino R., *Mearns 2545* (US). HIDALGO Co.: Animas Valley, s. of Animas, *Wolf 2580* (G).

ARIZONA: COCHISE Co.: Camp Bowie, *Lemmon 200* (G); Guadalupe Canyon, e. of Douglas, *Peebles 11698* (US); Ft. Bowie: June 25, 1894, *Fisher* (US), *Blumer 2298* (NY); near Gleeson, *Shreve 5382* (A, G, US); Chiricahua Mts., near Paradise: *McKelvey 605* (A, US), Turkey Cr., May 27, 1906, *Holmes* (US), Whitetail Cr., Dec. 1908, *Sudworth* (US); Swisshelm Mts., July 21, 1894, *Toumey* (A, NY). PIMA Co.: Santa Catalina Mts., June 16, 1881, *Pringle s.n.* (M, type of *B. pauciflora*, A, G, US); Bear Cr., Tucson, *Eastwood 8164* (A); Baboquivari Canyon, *Peebles, Harrison & Kearney 388* (US).

MEXICO: COAHUILA: Saltillo, *Palmer 232* (A).

B. rigida seems to be composed of two elements. One of these may possibly be a variety of *B. lanuginosa* that has adapted itself to the conditions of soil and climate of the Southwest: in its pubescence it resembles *B. lanuginosa* var. *albicans,* while in its fruit and pedicels it looks like *B. texana.* However, it seems advisable not to attempt any segregation until more material is available.

3. **Bumelia lacuum** Small, Man. S. E. Fl. 1034. 1933.

Armed evergreen shrub, 0.5–3 m. tall; branchlets, petioles, lower surface of leaves, and inflorescence densely covered with lustrous, appressed, rufous pubescence; leaves oblong-obovate to spatulate, 1–4 cm. long, 1–3 cm. broad, obtuse at apex, cuneate at base, mar-

gins slightly revolute; petioles 1–4 mm. long; sepals and corolla-lobes oblong-elliptic; corolla-tube short, lobes scarious, appendages ovate-lanceolate, acute at apex; staminodia ovate-elliptic, obtuse at apex, margins slightly crenulate; ovary subglobose, abruptly contracted into the style; fruit oblong- to elliptic-obovoid, 8–10 mm. long; seed elliptic-obovoid, 6–8 mm. long, pale tan.

Distribution: sandhills, usually in scrub, central peninsular Florida.

Specimens examined:

FLORIDA: exact locality unknown, *Rugel 161* (M); "E. Fla.", *Buckley* (G). BREVARD Co.: Indian R., *Palmer 326* (G, M). COLLIER Co.: Caxambas Isl., *Simpson 578* (G). COLUMBIA Co.: Lake City, *Rolfs 46* (M). DUVAL Co.: near Jacksonville, *Curtiss 1762'* (M). HIGHLANDS Co.: between Avon Park and Sebring: *Small & DeWinkeler 9042* (NY), Aug. 30–31, 1922, *Small, Small & DeWinkeler 10666*[*] (NY, fr. part of TYPE), *10755* (NY); n. of Kuhlman, Apr. 25, 1921, *Small & DeWinkeler 9965* (NY, fl. part of TYPE, G); near Sebring: *Harbison 29, 37* (A), *Palmer 27438* (A, M). LAKE Co.: near Eustis: *Hitchcock* (M), *Nash 818* (A, G, M, NY), *Harbison 9* (A). ORANGE Co.: e. of Maitland, *Baker 513* (A); edge of L. Apopka hammock, w. of McDonald, *Baker 504, 505, 506, 507, 508, 509, 510, 511a,b,z, 512a,b,z, 514, 515, 525, 544* (A); near Plymouth, *Palmer 38350* (A, M). OSCEOLA Co.: Kissimmee, Aug. 2, 1929, *O'Neill* (US). POLK Co.: near Bartow, *Palmer 38366* (A), near Frostproof, *Palmer 27385* (A); Winter Haven, *McFarlin 6678* (UT). SEMINOLE Co.: Oviedo, *Harbison 8, 9* (A).

B. lacuum is segregated from *B. tenax* because of its dwarfness. Also the pubescence is rufous and less lustrous.

4. Bumelia rufotomentosa Small in Bull. N. Y. Bot. Gard. **1**: 440. 1900, as *rufomentosa;* Man. S. E. Fl. 1033. 1933.

Armed shrub less than 1 m. high; branchlets and petioles densely covered with rufous tomentum; leaves coriaceous, obovate or oval, 1.5–4 cm. long, 0.5–3 cm. broad, rounded to slightly retuse at apex, cuneate at base, sparingly pubescent beneath; petioles very short, 1–3 mm. long; flowers few; pedicels 3–5 mm. long; sepals oblong-elliptic to suborbicular; corolla-lobes suborbicular, appendages ovate-lanceolate, obtuse at apex; staminodia ovate, acute at apex; ovary subglobose, gradually contracted into a stout style; fruit subglobose, 4–6 mm. in diameter.

Distribution: in pine woods, peninsular Florida.

Specimens examined:

FLORIDA: ALACHUA Co.: Gainesville, *Seibert 1411* (M). HILLSBOROUGH Co.: Tampa, May 1876, *Garber* (NY, TYPE, US). ORANGE Co.: Zellwood, *Baker 503a,b,c,z* (A). SUMTER Co.: Sumterville, *Curtiss 1764* (A, G).

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[*] *Small, Small & DeWinkeler 10666* distributed as "*Bumelia tenax* Willd." is apparently *Dipholis salicifolia* (L.) DC.

This species is possibly a pubescent form of *B. reclinata,* but it is recognized here as a separate species because of its rufous-tomentose branchlets and its villous ovary.

5. **Bumelia tenax** (L) Willd. in L. Sp. Pl. **1**[2]: 1085. 1798; Loud. Arb. & Frut. Brit. **2**: 1193, *fig. 1017.* 1838; DC. Prodr. **8**: 190. 1844; Nutt. Sylva **3**: 35, *pl. 92.* 1849; Sarg. Silva **5**: 169, *pl. 246.* 1893; Small in Bull. N. Y. Bot. Gard. **1**: 446. 1900.

Sideroxylon tenax L. Mant. 48. 1767, non Walt.

Chrysophyllum carolinense Jacq. Obs. 3: 3, *pl. 54.* 1768.

Sideroxylon sericeum Walt. Fl. Car. 100. 1788.

Sideroxylon chrysophylloides Michx. Fl. Bor. Am. **1**: 123. 1803.

Bumelia chrysophylloides Pursh, Fl. Am. Sept. **1**: 155. 1814; P. W. Wats. Dendr. Brit. **1**: 10, *pl. 10.* 1825.

Sclerocladus tenax Raf. Sylva Tellur. 35. 1838.

Sclerozus tenax Raf. Aut. Bot. 2: 73. 1840.

Bumelia reclinata Chapm. Fl. Southeast. U. S. 275. 1860, non Vent. nec Torr.

Lyciodes tenax O. Ktz. Rev. Gen. **2**: 406. 1891.

Shrub or small tree, 2–10 m. high; branchlets, petioles, lower surface of leaves and inflorescence densely covered with a tawny pubescence; branchlets slender, with reddish-brown bark, occasionally armed with stout spines, 2–2.5 cm. long; leaves oblong-obovate to oblanceolate, 2–7 cm. long, 0.5–3.5 cm. broad, obtuse at apex, cuneate at base, margins slightly revolute, midvein prominent; petioles 2–9 mm. long; inflorescence many-flowered; pedicels slender, 8–13 mm. long, slightly enlarged toward apex; sepals oblong-obovate to subglobose; corolla-lobes oblong-elliptic to subglobose, margins erose, appendages lanceolate, acute at apex, crenulate; staminodia broadly ovate, obtuse to rounded at apex, margins erose; ovary narrowly ovoid, gradually contracted into an elongated style; fruit oblong-ellipsoid, 10–14 mm. long, often tipped by a persistent style; seed oblong-obovoid, 10–12 mm. long, apex tuberculate, variegated.

Distribution: dry, sandy soil along sea-coast, South Carolina to Florida.

Specimens examined:

CAROLINA: precise data lacking, *Walter s.n.* (G, fragment of type of *Sideroxylon sericeum).*

SOUTH CAROLINA: BEAUFORT CO.: Bluffton, 1871–99, *Mellichamp* (A, G, M); St. Helena Isl., *Harbison 10* (A). CHARLESTON CO.: Sullivan Isl., *Ravenel* (G).

GEORGIA: CHATHAM CO.: near Savannah, *Beyrich* (P). GLYNN CO.: Brunswick, *Harbi-*

son 4, 5, 1222 (A). LIBERTY Co.: Colonels Isl., *Harbison 26* (A); St. Catherines Isl., *Harbison 9, 10* (A). MCINTOSH Co.: *Harbison 2, 3, 4* (A).

FLORIDA: exact locality unknown, *Rugel 320* (M). BREVARD Co.: along Indian R., Tropic, Merritts Isl., *N. Y. State College of Forestry, Proj. I, 8334*, coll. by Rhoads (A). CLAY Co.: Magnolia Springs, *Harbison 7051a* (A). DUVAL Co.: *Fredholm 5345* (G); near Jacksonville, *Curtiss 1762*, in part, *4362, 5678* (M). LAKE Co.: Eustis, *Nash 1662* (A, P). ST. JOHNS Co.: near Matanzas, *Harbison 6* (A). VOLUSIA Co.: Seabreeze, *Webber 467* (M).

B. tenax is a coastal species characterized by dense, tawny sericeous pubescence.

6. **Bumelia anomala** (Sarg.) Clark, comb. nov.

Bumelia lanuginosa var. *anomala* Sarg. in Jour. Arn. Arb. **2**: 169. 1922.

Small tree; branches glabrous, armed with occasional stout spines, bark yellowish-gray; leaves coriaceous, oblong-obovate to broadly elliptic, 1.5–6.5 cm. long, 1–3 cm. broad, rounded to obtuse at apex, obtuse at base, lower surface densely covered with lustrous, appressed, silvery pubescence, margins slightly revolute; petioles 2–6 mm. long; inflorescence few-flowered; pedicels 3–5 mm. long, slightly enlarged toward apex; sepals oblong-elliptic to subglobose, rounded at apex; corolla-lobes oblong-elliptic to subglobose, rounded at base and apex, erose, appendages linear-lanceolate, crenulate; staminodia broadly ovate, obtuse at apex, crenulate; ovary broadly ovoid, abruptly contracted into an elongated style; fruit not observed.

Distribution: in sandy or rocky upland woods, Gainesville and Orlando, Florida.

Specimens examined:

FLORIDA: ALACHUA Co.: Gainesville: June 17, 1917, *Harbison 47* (A, TYPE), *61, 64, 97* (A). ORANGE Co.: near Orlando, *Harbison 51* (A).

A close examination of this entity reveals that it is not an anomalous form of *B. lanuginosa,* but rather a distinct species, perhaps more closely related to *B. tenax.* It is distinguished from *B. tenax* by its broad leaves and silvery pubescence. In shape of leaf it resembles *B. rufa,* but its pubescence is not at all reddish.

7. **Bumelia rufa** Raf. New Fl. N. Am. 3: 29. 1836; Aut. Bot. 2: 74. 1840.

Bumelia ferruginea Nutt. Sylva **3**: 34. 1849.

Branchlets, petioles, lower surface of leaves and inflorescence densely covered with a tawny pubescence; leaves elliptic, about 5 cm. long, about 3 cm. broad, obtuse or acutish at apex, obtuse or

rounded at base; flowers glomerate or in many-flowered fascicles; pedicels stout, 3.5 mm. long; sepals reniform to oblong-elliptic, rounded at apex; corolla-tube short, lobes suborbicular, truncate at base, appendages lanceolate, acute at apex; staminodia broadly obovate, obtuse at apex; ovary ovoid, gradually contracted into a stout style; fruit not observed.

Distribution: western Florida.

Specimen examined:
FLORIDA: "W. Fla.", *Ware* (P, TYPE).

Although it is not unlikely that the type specimen represents a teratological form of the *B. lanuginosa* complex, convincing evidence for this supposition has not been found. It therefore seems advisable to maintain this species, pending further collections in "W. Fla."

8. **Bumelia lycioides** (L) Pers. Syn. **1**: 237. 1805; Gaertn. f. in Gaertn. Fruct. & Sem. **3**[1]: 127, *pl. 202, fig. 3.* 1805; DC. Prodr. **8**: 189. 1844; Nutt. Sylva **3**: 31, *pl. 91.* 1849; Small in Bull. N. Y. Bot. Gard. **1**: 444. 1900.

Sideroxilon spinosum Duham. Arb. **2**:260, *pl. 68.* 1755.
Sideroxylon lycioides L. Sp. Pl., ed. 2, 279. 1762.
Sideroxylon decandrum L. Mant. 48. 1767.
Sideroxylon laeve Walt. Fl. Car. 100. 1788.
Lyciodes spinosum O. Ktz. Rev. Gen. **2**: 406. 1891.

Shrub or small tree, 1–8 m. high; branches clothed in gray bark and armed occasionally with short spines; leaves oblong-elliptic to oblong-obovate, 3.5–13 cm. long, 1.5–5 cm. broad, obtuse to acuminate at apex, pale green and prominently reticulate on both surfaces; petioles 5–15 mm. long; flowers numerous; pedicels 2–12 mm. long; perianth scarious, glabrous; sepals and corolla-lobes oblong-elliptic, appendages lanceolate to ovate-lanceolate; staminodia oblong-ovate, obtuse at apex; ovary subglobose, rather abruptly contracted into an elongated style; fruit obovoid to oblong-obovoid, 8–10 mm. long; seed obovoid, 6–8 mm. long.

Distribution: in moist situations, southeastern Virginia to northern Florida, westward to southern Illinois and Louisiana.

Specimens examined: the TYPE specimen, without exact locality and date of collection, is preserved in the Herbarium of the Linnean Society, London (G, photograph).
VIRGINIA: ISLE OF WIGHT CO.: near Smithfield, Oct. 1933, *Stott* (US).
CAROLINA: precise data lacking, *Walter s.n.* (G, fragment of type of *Sideroxylon laeve*).
NORTH CAROLINA: Churchs Isl., *McAtee 1212* (US). NEW HANOVER CO.: Wrightsville,

Williamson 111 (P); near Wrightsville Beach, Wilmington, *Harbison 34* (A). ROWAN Co.: near Salisbury, *Biltmore Hb. 1689c* (A).

SOUTH CAROLINA: ABBEVILLE Co.: Calhoun Falls, *Harbison 36* (A). BEAUFORT Co.: Bluffton, *Mellichamp* (A). HORRY Co.: Little R. Inlet, *Harris C19598* (US).

GEORGIA: exact locality unknown, *Boykin* (G, M). CAMDEN Co.: St. Marys R., *Harris C21149A* (US). CATOOSA Co.: near Ringgold, Aug. 10, 1895, *Small* (A, US). RICHMOND Co.: Augusta, *Harbison 10* (A). STEWART Co.: along Chattahoochee R., *Harper 1100* (G, M). WALKER Co.: summit of Bluebird Gap, Pigeon Mt., *Harper 365* (NY).

FLORIDA: near Mosquito Inlet, *Curtiss 1761*, in part (M). GADSDEN Co.: River Junction, *Harbison 140* (A). JACKSON Co.: Aspa R., near Aspalaga, July 1843, *Rugel* (M). JEFFERSON Co: near L. Miccosukee, *Palmer 38459* (A). LAKE Co.: Wekiwa Springs, Aug. 12, 1929, *O'Neill* (US).

ALABAMA: exact locality unknown, *Drake* (G), *Buckley 19* (P). DALLAS Co.: Alabama R., Selma, *Harbison 94* (A). ETOWAH Co.: n. of Attalla, July 9, 1898, *Eggert* (M). JACKSON Co.: Scottsboro, June 30, 1899, *Earle* (NY). JEFFERSON Co.: Powderly, *Palmer 35353* (A, M); along Little Cohaba Cr., *Palmer 38935* (A, M). MARENGO Co.: near Demopolis, *Palmer 27205* (A, M). WILCOX Co.: June 1841, *Buckley* (G, M, US).

MISSISSIPPI: CLARK Co.: Enterprise, *Tracy 3289* (NY). HINDS Co.: s. of Jackson, *Harbison 95* (A). MARION Co.: Columbia, Oct. 28, 1894, *Mohr* (US).

TENNESSEE: DAVIDSON Co.: near Nashville, *Biltmore Hb. 1689b* (A, G, M). DYER Co.: Dyersburg, *Palmer 17263* (A, G, M). FRANKLIN Co.: Cumberland Mt., Cowan, July 21, 1897, *Eggert* (M). MONTGOMERY Co.: bluffs of Cumberland R., Clarksville, *Palmer 17579* (A, M). RUTHERFORD Co.: near Murfreesboro, *Palmer 35496* (A, M).

KENTUCKY: exact locality unknown, 1842, *Short* (G, M, Tu). BALLARD Co.: near Swan Pond, *McFarland, Shacklette & Plymale 43* (M). LOGAN Co.: Russellville, *Palmer 17749* (A, M). LYON Co.: Eddyville, *Palmer 17863, 22506, 23703* (A, M); near Star Lime Works, *Shacklette 440-b* (G). MUHLENBERG Co.: Central City, *Palmer 17731* (A, G, M). WARREN Co.: Jenning's Cr., Bowling Green, May-Aug. 1895, *Price* (A M),

ILLINOIS: ALEXANDER Co.: Cairo, *Palmer 14930* (A). HARDIN Co.: Cave-in Rock, *Palmer 15473* (A, M). POPE Co.: near Ohio R., Golconda, *Palmer 15376, 23776* (A, M). PULASKI Co.: Mound City: June 1861, *Vasey* (G, M), *Palmer 15078, 16583* (A, M).

LOUISIANA: W. FELICIANA Parish: Wakefield, June 1907, *Cocks* (A).

Though infrequently collected, *B. lycioides* is a variable and widespread species. Like *B. Smallii*, it grows near water-courses.

8a. Bumelia lycioides var. **virginiana** Fernald in Rhodora **38**: 439. 1936; Sarg. Silva **5**: *pl. 248.* 1893.

Shrub or small tree to height of 3 m.; leaves 1.5–13.5 cm. long, 1–3.5 cm. broad generally rounded at apex, bright to pale green; petioles stout, 2–12 mm. long; inflorescence rather few-flowered; pedicels 3–9 mm. long; fruit obovoid; seed pale.

Distribution: dry wooded slopes and margins of streams, southeastern Virginia to Georgia; also southern Indiana.

Specimens examined:

VIRGINIA: ELIZABETH CITY Co.: Ft. Monroe, May 30, 1878, *Chickering* (A). NORFOLK Co.: Sewell's Pt., June 28, 1872, *Curtiss* (G, M). PRINCE GEORGE Co.: near James R., Upper Brandon, *Fernald & Long 9393* (G); Carter's Cr., York R., *Grimes 4269* (G, NY). PRINCESS ANNE Co.: near Third St. bridge, Great Neck: *Fernald & Griscom 4492* (G),

Fernald, Griscom & Long 4688 (G), *Fernald & Long 4987* (G, TYPE, M); Little Neck, *Fernald & Long 4988* (G, M).

NORTH CAROLINA: NEW HANOVER Co.: near Wrightsville, *Biltmore Hb. 1689a* (A, G, M).

SOUTH CAROLINA: BEAUFORT Co.: Bluffton, *Mellichamp* (A).

GEORGIA: FRANKLIN Co.: near Royston, *Palmer 42448* (M).

INDIANA: PERRY Co.: Ohio R. bluffs, above Cannelton, *Deam 16602* (A).

8b. **Bumelia lycioides** var. **ellipsoidalis** Clark, var. nov.[7]

Small tree, 8–10 m. high; leaves elliptic to oblong-elliptic, 5–12 cm. long, 2–4 cm. broad; petioles slender, 4–5 mm. long; inflorescence many-flowered; pedicels 4–8 mm. long, only slightly, if at all, enlarged toward apex; sepals broadly ovate; fruit ellipsoid, 10–15 mm. long, 6–8 mm. broad, black and fleshy; seed 8–10 mm. long, 4–5 mm. broad, tan.

Distribution: in open woods on loess hillsides, Tennessee, south to northern Alabama, Mississippi, and eastern Arkansas.

Specimens examined:

TENNESSEE: DAVIDSON Co.: Nashville: July-Sept. 1879, *Gattinger s.n.* (M, TYPE), July-Aug. 1879, *Gattinger* (A), *Curtiss 1761*, in part, coll. by Gattinger (G, M), Oct. 20, 1887, *Gattinger* (A, M).

ALABAMA: CALHOUN Co.: Tarsus, *Cocks* (A). FRANKLIN Co.: Russellville, Sept. 1893, *Mohr* (A).

MISSISSIPPI: OKTIBBEHA Co.: Agricultural College, *Pollard 1336* (G, M); Starkville, *Tracy 2009* (A).

ARKANSAS: PHILLIPS Co.: Crowley's Ridge near Helena, *Palmer 26649* (A, M).

This variety is characterized by its ellipsoid fruit and its limited distribution.

9. **Bumelia Smallii** Clark, nom. nov.

Bumelia lucida Small in Bull. N. Y. Bot. Gard. **1**: 443. 1900; Britt. N. Am. Trees, 778, *fig. 709.* 1908, non Roem. & Schult.

Glabrate shrub or small tree, 2–7 m. high; branches slender, reddish-brown, armed with short spines; leaves numerous, coriaceous, elliptic to elliptic-ovate, 2–5 cm. long, 1–2 cm. broad, acute to occasionally rounded at apex, cuneate at base, dark green and lucid above, paler and dull beneath, reticulate on both surfaces; petioles slender, 3–8 mm. long; flowers rather numerous; pedicels glabrous, slender, 3–7 mm. long; perianth scarious; sepals oblong-elliptic to suborbicular; corolla-lobes oblong-elliptic, appendages ovate-lanceolate, acute at apex, erose; staminodia broadly ovate, obtuse at apex; ovary ovoid; fruit subglobose, 7–10 mm. in diameter, dark

[7] **Bumelia lycioides** var. **ellipsoidalis** a specie fructu ellipsoideo differt.

bluish-black; seed subglobose, 6–9 mm. in diameter, variegated pale tan and brown.

Distribution: in low wet woods, southeastern Missouri, south to Louisiana and eastern coastal Texas.

Specimens examined:

MISSOURI: BUTLER Co.: Neelyville: *Bush 6866* (M), *Sargent 6866* (A). NEW MADRID Co.: Oct. 18, 1856, *Swallow* (M).

ARKANSAS: BRADLEY Co.: Warren, *Demaree 18967* (M). CLAY Co.: Corning, *Demaree 4235* (M). CRAIGHEAD Co.: bottoms of St. Francis R., Bono, *Demaree 3532* (M). CRITTENDEN Co.: Turrell, *Demaree 3728* (M). HEMPSTEAD Co.: along Yellow Cr., near McNab, *Palmer 26725* (A, M). JACKSON Co.: near Newport, *Palmer 35532* (A, M).

LOUISIANA: exact station lacking: *Riddell* (NY), *Featherman 95* (NY), 1836, *Hale* (G, M), no date, *Hale* (NY). ARCADIA Parish: Esterwood, *Brown 6287* (L). E. BATON ROUGE Parish: Baton Rouge, Apr. 3, 1899, *Anders* (L). FELICIANA Parish: 1838, *Carpenter 19* (NY, TYPE). ORLEANS Parish: New Orleans: *Drummond 207,* in part (G), near L. Ponchartrain, May 1838, *Riddell* (US), Apr. 16, 1846, *Fendler* (M); Audubon Pk., Oct. 6, 1936, Apr. 5, 1937, *Penfound* (Tu). OUACHITA Parish: Monroe, *Brown 6041* (L). PLAQUEMINES Parish: English Turn on Mississippi R., Sept. 1879, *Langlois* (NY). RAPIDES Parish: Alexandria, *Ball 528* (G, M). ST. LANDRY Parish: Opelousas, 1880–83, *Letterman* (M). ST. MARTIN Parish: near St. Martinsville, Oct. 16, 1893, *Langlois* (US), *45* (M). TERREBONNE Parish: n. of Houma, Oct. 28, 1912, May 22, 1913, *Wurzlow* (NY). W. CARROLL Parish: Oak Grove, *Copes* (L).

TEXAS: BRAZORIA Co.: Columbia: *Bush 141, 945* (M), Brazos R., *Palmer 5067, 6690* (M). CHAMBERS Co.: White's Ranch, *Tharp 3218* (UT). JEFFERSON Co.: Beaumont, *Palmer 12722, 13084* (A, M).

The specific designation of this plant, being preoccupied by Roemer and Schultes' binomial, must be changed. I therefore take pleasure in dedicating this species to the late Dr. John K. Small.

B. Smallii is the complement of *B. lycioides,* inhabiting for the most part the river banks west of the Mississippi River. Its leaves are consistently smaller than in *B. lycioides,* are smooth and shiny, and the pedicels are gracefully cuneate. The fruit is more or less globose.

10. **Bumelia reclinata** (Michx.) Vent. Choix des Plantes, *pl. 22.* 1803; DC. Prodr. **8**: 190. 1844; Small in Bull. N. Y. Bot. Gard. **1**: 441. 1900, non Chapm. nec Torr.

Sideroxylon reclinatum Michx. Fl. Bor. Am. **1**: 122. 1803.

Bumelia macrocarpa Nutt. Sylva **3**: 34. 1849.

Bumelia lycioides var. *reclinata* (Vent.) Gray, Syn. Fl. N. Am. **2**[1]: 68. 1878.

Bumelia microcarpa Small in Bull. N. Y. Bot. Gard. **1**: 440. 1900.

Decumbent or ascending shrub, 1–2 m. high; branches slightly geniculate, spinescent; leaves numerous, thin, obovate-spatulate to oblanceolate, 2–7 cm. long, 0.5–4 cm. broad, rounded or retuse at

apex, cuneate at base, dark green and shiny above, paler and dull beneath, rather prominently reticulate; petioles 2–4 mm. long; inflorescence few-flowered; pedicels 3–5 mm. long, enlarged toward apex; sepals oblong-obovate to suborbicular; corolla-lobes suborbicular, slightly erose, appendages lanceolate, slightly erose; staminodia lanceolate, not plicate, slightly erose; ovary glabrous, suborbicular to ovoid, gradually contracted into a stout style; fruit subglobose, 4–6 mm. in diameter, frequently tipped by a persistent style; seed subglobose, 3–6 mm. in diameter, brown, occasionally variegated.

Distribution: in sandy soil, Georgia to Florida and Louisiana.

Specimens examined:

GEORGIA: exact place and date of collection unknown, *Michaux s.n.* (G, fragment of TYPE); complete data lacking, *Nuttall s.n.* (P, type of *B. macrocarpa).* THOMAS Co.: along Ochlockonee R., near Thomasville, May 28–June 6, 1895, *Small* (NY).

FLORIDA: exact locality unknown: *Rugel 101* (M, US), *Garber 24* (G, M). ALACHUA Co.: *Harbison 104, 108* (A); Gainesville: Mar.–June 1876, *Garber s.n.* (NY, type of *B. microcarpa,* US), *Palmer 38429* (A, NY). COLLIER Co.: Tommy Cypress, head of Chokoloskee R., *Small 7751* (NY). DADE Co.: near Homestead Rd. between Cutler and Longview Camp, *Small & Carter 1469* (NY); Homestead to Big Hammock Prairie, *Small, Carter & Small 3406* (N); Camp Jackson to Camp Longview, *Small, Carter & Small 3500* (NY); Paradise Key: *Bessey 2* (A), *Harper 110* (A), *Rehder 898* (A), Royal Palm Pk., *Fisher 54* (US); Camp Jackson, *Britton 218, 219* (NY); Nixon-Lewis Hammock, *Small & Mosier 6400* (NY). DIXIE Co.: near Cross City, *Palmer 27301* (A). FRANKLIN Co.: Chattahoochee, 1896, *Chapman* (M). GADSDEN Co.: River Junction, *Harbison 119, 123* (A). HIGHLANDS Co.: Kissimmee Prairie, e. of L. Istokpoga, *Small, Mosier & DeWinkeler 10897* (NY, US). HILLSBOROUGH Co.: Tampa, June–July 1898, *Ferguson* (M). JACKSON Co.: near Grand Ridge, *Palmer 35266* (A, M, NY); Marianna, *Harbison 2, 28* (A). LAKE Co.: Eustis, *Nash 1261* (G, NY). LEE Co.: n. of Bonita Springs, *Seibert 1386* (M); Estero, Jan. 28, 1920, *Ames* (A); Ft. Myers: *Standley 154* (A, G, M, NY), *Hitchcock 199* (G, M, NY); Samville, June 6, 1912, *Harshberger* (NY). LEON Co.: s. of Tallahassee, *Palmer 38484* (A). MANATEE Co.: Manatee, June 1878, *Garber* (G). MONROE Co.: Long Key: *Small & Wilson 1852* (NY, US), *Small & Carter 2912, 2986, 2987, 2988, 2988a* (NY); Flamingo, Cape Sable Region, *Small, Small & DeWinkeler 11537* (G, NY, US). OKEECHOBEE Co.: Okeechobee Prairie, e. of Ft. Bassinger, *Small, Mosier & DeWinkeler 10944* (G, M, NY). OSCEOLA Co.: *Fredholm 5832* (G, NY). SARASOTA Co.: s. of Venice, *Seibert 1392* (M). SUWANNEE Co.: banks of Suwannee R., Branford, *Curtiss 6656* (A, G, M, NY). TAYLOR Co.: near Hampton Springs, *Palmer 38471* (A, M, NY); Perry, *Harbison 3* (A). VOLUSIA Co.: near Mosquito Inlet, *Curtiss 1761,* in part (A, G, M, NY); near Seville, *Curtiss 6690* (A, G, M, NY); edge of causeway, n. of St. Johns R. bridge, *Baker 516* (A). WAKULLA Co.: St. Marks, *Harbison 1503* (A).

LOUISIANA: exact locality unknown, *Hale* (G, NY).

11. Bumelia cassinifolia Small in Bull. N. Y. Bot. Gard. **1**: 442. 1900; Britt. N. Am. Trees, 778, *fig. 708.* 1908.

Glabrous shrub or small tree, 5–10 m. high; branches slender, frequently armed with short, stout spines, clothed in reddish-brown

bark; leaves thinnish, oblong-obovate, 2.5–10 cm. long, 1–4.5 cm. broad, acute to rounded at apex, cuneate at base, margins slightly revolute, dark green and reticulate above, paler and puberulent beneath with midvein and secondary nerves prominent; petioles slender, 6–8 mm. long; inflorescence few-flowered, glabrous; pedicels slender, 4–11 mm. long, slightly enlarged toward apex; sepals and corolla-lobes suborbicular, appendages lanceolate or ovate-lanceolate, obtuse to acuminate at apex, erose; staminodia broadly lanceolate or ovate, obtuse at apex; ovary ovoid, gradually contracted into an elongated style; fruit subglobose, 8–12 mm. in diameter; seed subglobose to broadly ovoid, 6–10 mm. long.

Distribution: in moist, sandy soil, southwestern Georgia to Louisiana.

Specimens examined:

GEORGIA: DECATUR Co.: along Flint R., near Bainbridge, *Harbison 1357, 1358* (A).

FLORIDA: JACKSON Co.: n. of Marianna, *Wiegand & Manning 2487* (G).

LOUISIANA: ST. LANDRY Parish: alt. 60 ft., Opelousas, May.–Aug. 11, 1883, *Letterman 287* (NY, TYPE).

B. cassinifolia is a rare plant having the foliage characters of a very vigorous *B. reclinata* and the fruiting characters of *B. Smallii*. It may possibly prove to be of hybrid origin.

12. **Bumelia texana** Buckl. in Bull. Torr. Bot. Club **10**: 91. 1883, as *Texana;* Small in Bull. N. Y. Bot. Gard. **1**: 443. 1900.

Bumelia reclinata Torr. Bot. Mex. Bound. Surv. 109. 1859, *pro parte,* non Vent. nec Chapm.

Bumelia monticola Buckl. in Bull. Torr. Bot. Club **10**: 91. 1883; Sarg. Man., ed. 2, 814, *fig. 725.* 1922.

Armed shrub or small tree, 1–7 m. high, with reddish-brown bark; lower surface of leaves, petioles, and inflorescence glabrescent; leaves coriaceous, generally obovate-spatulate, 1–7 cm. long, 0.5–3 cm. broad, rounded to retuse or even apiculate at apex, often slightly revolute, obtuse to cuneate at base, prominently reticulate and pale green on both surfaces; petioles slender, 3–10 mm. long; inflorescence few-flowered; pedicels 1-6 mm. long, enlarged toward apex; sepals subreniform to suborbicular; corolla-lobes oblong-elliptic, appendages ovate-lanceolate; staminodia ovate-lanceolate, obtuse to rounded at apex; ovary subglobose, abruptly contracted into an elongated style; fruit obovoid, 8–10 mm. long, often tipped by a persistent style; seed oblong-ellipsoid, 6–8 mm. long, variegated, red-brown and tan.

Distribution: in dry limestone soil, Arbuckle Mountains in Oklahoma, and west-central Texas.

Specimens examined:

OKLAHOMA: MURRAY Co.: Arbuckle Mts., *Clark & Williams 510* (M).

TEXAS: mountains near lower crossing of Pecos R., W. Tex., 1875, *Buckley* (NY, TYPE); "W. Tex.–N. Mex.", *Wright 422* (G, NY, US); Live Oak Cr.: *Wright 1434* (A, G, NY), *Bigelow s. n.* (NY, type of *B. reclinata* Torr.). BEXAR Co.: *Jermy 83* (NY), *117* (M); Leon Springs, *Clemens & Clemens 891, 893* (M); Blanco Rd. at Cibolo Cr. crossing, n. of San Antonio, *Metz 419* (NY). BLANCO Co.: Blanco: *Reverchon 1555* (A, M, US), *Cory 15629* (A). BREWSTER Co.: Dog Gap, Santiago Mts.: Apr. 14, 1936, *Cory* (A), *Parks & Cory 18702* (Tr.). BROWN Co.: near Brownwood, *Palmer 29539, 29567* (A). BURNET Co.: Burnet, *Palmer 10257* (A, M). CALLAHAN Co.: Baird, *Palmer 13678, 13679* (A, M). COLEMAN Co.: Santa Anna, *Palmer 10386* (A, M). COKE Co.: Bronte, *Palmer 10355* (A, M). COMAL Co.: New Braunfels, *Lindheimer 199* (M); "Devil's Backbone," *Palmer 12187, 12207* (A); Fischer's Store, *Palmer 12208, 12208a* (A). CONCHO Co.: n.w. of Paint Rock: *Cory 9761, 9763* (A), *Parks & Cory 9762* (Tr). CROCKETT Co.: *Reverchon 97* (G). EDWARDS Co.: *Palmer 10975* (A). EL PASO Co.: mountains, 1875, *Buckley s.n.* (NY, type of *B. monticola).* GILLESPIE Co.: Bear Mt.: *Cory 12925, 12926* (A), *Parks & Cory 12926* (Tr); Fredericksburg, *Palmer 10057* (A, M). HARDIN Co.: s. of Silsbee, *Cory 11278, 11279* (A). HOWARD Co.: Big Spring, *Palmer 12483, 13066* (A, M). IRION Co.: Mertzon, *Palmer 12426* (A, M). KENDALL Co.: Boerne, *Palmer 9840, 10818, 11599, 12270, 13637, 13648* (A, M); Spanish Pass, *Cory 19343* (A). KERR Co.: Kerrville: *Heller 1938* (NY, US), *Mackenson 5* (A), *Palmer 9937, 12210* (A, M); Lacey's Ranch, *Palmer 10007, 11226, 12229a* (A). KIMBLE Co.: Junction, *Palmer 10913* (A, M). MENARD Co.: Menard, *Palmer 11888, 11899* (A). MITCHELL Co.: Colorado: June 9, 1900, *Eggert* (M), *Palmer 13787* (A, M). NOLAN Co.: Sweetwater: Palmer *12431, 13051, 14522, 14523, 33973* (A, M), Aug. 3, 1934, *Barkley* (M, UO). PALO PINTO Co.: Strawn, *Palmer 14246* (A, M, US). PECOS Co.: near Sheffield, *Ferris & Duncan 2919* (M). REAL Co.: Barksdale, *Palmer 13525* (A, M); Leaky, *Palmer 10148* (A, M). SAN SABA Co.: San Saba, *Palmer 11810* (A, M). SUTTON Co.: head of Llano R., between Sonora and Sawyer Spring, *Eggleston 16729* (NY); s.e. of Sonora: *Cory 15315* (A), *Parks & Cory 15314* (Tr). TERRELL Co.: near Sanderson, *Palmer 33442* (A). TOM GREEN Co.: banks of Concho R., San Angelo: *Reverchon 3868* (M), *Palmer 10322, 10360* (M). UVALDE Co.: bluffs of Frio R., Concan, *Palmer 10203, 11545* (A, M); Uvalde, *Palmer 11321, 11347* (A); Leona R., *Parks & Cory 23871* (Tr). VALVERDE Co.: Comstock, *Palmer 11063* (A); near Shumla, *Palmer 33489* (A, M, NY).

A glabrous or glabrescent shrub or small tree, *B. texana* has leaves which vary from long and spatulate to short and obovate. There may possibly be two elements here; nevertheless *B. texana* and *B. monticola* are conspecific.

13. Bumelia megacocca Small in Bull. N. Y. Bot. Gard. **1**: 441. 1900, as *megococca*.

Evergreen, glabrous, thorny shrub with spreading or procumbent branches and with pale bark in angular, corky ridges broken by numerous lenticels; leaves coriaceous, obovate or oblong-oblanceolate, 1–3.5 cm. long, 0.5–1.2 cm. broad, rounded or retuse at apex, deep green and somewhat shiny above, paler and prominent-

ly reticulate beneath, slightly revolute, short-petiolate; pedicels stout, 1–3 mm. long; flowers not observed; fruit subglobose, 10–13 mm. in diameter, black; seed 9–10 mm. in diameter, pale, smooth and shiny, variegated.

Distribution: in sandy soil, Florida.

Specimen examined:

FLORIDA: HILLSBOROUGH Co.: Tampa, Oct. 1877, *Garber s.n.* (NY, fragment of TYPE).

The only available material is a fragmentary fruiting specimen which seems to be a *Bumelia.*

14. **Bumelia angustifolia** Nutt. Sylva **3**: 38, *pl. 93.* 1849; Sarg. Silva **5**: 175, *pl. 249.* 1893; Small in Bull. N. Y. Bot. Gard. **1**: 439. 1900.

Bumelia reclinata Torr. Bot. Mex. Bound. Surv. 109. 1859, *pro parte,* non Vent. nec Chapm.

Bumelia cuneata Gray, Syn. Fl. N. Am. **2**^{1}: 68. 1878, non Sw.

Lyciodes angustifolium O. Ktz. Rev. Gen. **2**: 406. 1891.

Bumelia parvifolia Chapm. Fl. Southeast. U. S., ed. 3, 295. 1897, non A. DC.

Bumelia Schottii Britt. N. Am. Trees, 777. 1908.

Glabrous shrub or small tree, 2–8 m. high; branchlets unarmed and slender or spinescent and stout; leaves numerous, variable, persistent, coriaceous, narrowly oblanceolate-spatulate to obovate, 1–1.5 cm. long, 0.5–2 cm. broad, rounded to acutish at apex, cuneate, pale green or grayish and smooth above, brighter green and obscurely reticulate beneath, margins slightly revolute; petioles 1–10 mm. long; inflorescence few- to many-flowered; pedicels 3–11 mm. long; sepals oblong-elliptic, erose, appendages ovate-lanceolate, acute at apex, erose; staminodia ovate, acute at apex, erose; ovary ovoid, gradually contracted into a slender, elongated style; fruit oblong- to ellipsoid-cylindrical, 8–10 mm. long, purplish-black, fleshy, usually tipped by a long, persistent style; seed oblong-ellipsoid, 6–8 mm. long, narrowed at base, pale.

Distribution: in sandy soil, Florida, Texas and adjacent Mexico, also in Bahama Islands.

Specimens examined:

FLORIDA: BREVARD Co.: Merritts Isl., *Harris C19999* (US). CHARLOTTE Co.: Bocagrande, Jan.–Feb. 1920, *Ames* (A). COLLIER Co.: Ten Thousand Isls., *Simpson 364* (G). DADE Co.: Planter, Key Largo, *Eaton 444* (A); lower end of Old Rhoades Key, Apr. 1911, *Simpson* (A). HILLSBOROUGH Co.: Tampa Bay: *Leavenworth* (G, NY); Paradise Key, *Maxon 10926* (US). LEE Co.: Coconut, *Moldenke 5780* (NY); Ft. Myers, *Chapman 14* (US); Marco, *Standley 12808* (US); Sanibel Isl., Apr. 10, 1886, *Sargent* (A). LEVY

Co.: Cedar Keys, *Garber 25* (G, US). MANATEE Co.: Terra Ceia Isl., *Simpson 276* (G, US). MONROE Co.: Bahia Honda Key, May 1881, *Curtiss 1765* (G, M, US); s. border of everglades, Jan. 1882, *Curtiss 1765* (A, M, US); Big Pine Key, *Seibert 1276, 1311* (M); e. of Cape Sable, Nov. 1912, *Simpson* (A); Key West: *Blodgett s.n.* (NY, part of TYPE, G), *Chapman s.n.* (NY, co-type of *B. parvifolia)*, *Rugel 86, 87* (G), *132, 174* (NY), Nov. 28, 1886, *Sargent* (A, G), *Britton 508, 509* (NY), *Small & Small 4909* (G), *Seibert 1236* (M); Lignum-vitae Key, Apr. 1911, *Simpson* (A); Long Key, *Curtiss 503* (A); Marquesas Key, Apr. 12, 1886, *Sargent* (A); Palm Key near Flamingo, *Howell 1146* (A); Sugarloaf Key, *Pennell 9581* (M, NY); Upper Metacombe Key, Nov. 15, *Curtiss* (A).

TEXAS: Torrecillas, *Griffiths 6424* (M). ARANSAS Co.: Copano Bay, *Tharp 1550, 1664* (US, UT). ATASCOSA Co.: *Schulz 108, 482* (US); Campbelton, *Palmer 11230* (A, G). CALHOUN Co.: Indianola: *Cory 11617* (A), *Parks & Cory 11617* (Tr); Magnolia Beach, May 22, 1930, *Tharp* (UT). CAMERON Co.: Brownsville: *Hanson 451* (US), *Runyon 252* (M, US, UT), *Rose & Russell 24190* (A, US), *24190a* (NY); Rio Hondo, *Chandler 7088* (G, M, NY); Santa Maria, May 13, 1889, *Tucker* (A, US). DIMMIT Co.: El Jardin, *Small & Wherry 11889* (NY). FRIO Co.: Dilley, Dec. 16, 1932, *Parks* (Tr). HIDALGO Co.: n.w. of Edinburg, *Clover 1599* (UT); La Joya, Mar. 2, 1940, *Parks* (Tr); near Mission: *Hanson 336* (G, M, NY, US, UT), *Clover 181* (M), *Walker 17819* (Tr); Tabasco, *Clover 1372* (A). JACKSON Co.: E. Karankawa Pt., *Tharp 1419* (UT). LA SALLE Co.: near Encinal, May 1, 1882, *Buckley* (A); near Nueces, Aug. 1881, *Buckley* (A, NY), Oct. 1881, *Buckley* (US). MATAGORDA Co.: w. of gulf: *Cory 11555* (A), *Parks & Cory 11555* (Tr). NUECES Co.: n.w. of Corpus Christi, *Cory 17076* (A); Osa Bay: *Cory 20566* (A), *Parks & Cory 20565* (Tr). STARR Co.: s. of Hebbronville, *Tharp 5936* (UT); near Rio Grande City, Sept. 10–11, 1929, *Tharp* (UT). WEBB Co.: near Laredo: *Rose 18047* (NY, US), Apr. 12, 1936, *Penfound* (Tu), June 1853, *Schott 69½* (NY, type of *B. Schottii)*; s. of Milo: *Cory 16901* (A), *Parks & Cory 16900* (Tr).

MEXICO: NUEVO LEON: near Monterrey, *Pringle 2787* (A).

BAHAMA ISLANDS: Hog Isl., New Providence, *Wilson 8317* (M).

A distinct, though variable species, *B. angustifolia* is easily recognized by its entirely glabrous foliage.

Doubtful and Excluded Species

Bumelia ambigua Ten. Sem. Hort. Neap. 1827.

Bumelia confertiflora Nutt. in Fras. Cat. No. 12. 1813, *nomen nudum.*

Bumelia denticulata Raf. New Fl. N. Am. 3: 29. 1836. Rafinesque later stated, in Aut. Bot. 2: 74. 1840, that this is "certainly no *Bumelia.*"

Bumelia lucida Roem. & Schult. Syst. **4**: 499. 1819 = SIDEROXYLON LUCIDUM Soland. ex Lam., fide DC. Prodr. **8**: 194. 1844.

Bumelia pubescens Ten. Sem. Hort. Neap. 1827.

Bumelia serrata Pursh, Fl. Am. Sept. **1**: 155. 1814 = PRUNUS CAROLINIANA Ait., fide Nutt. Gen. **1**: 136. 1818; S. Wats. Bibl. Ind. N. Am. Bot. 304. 1878.

Bumelia serrulata Raf. New Fl. N. Am. 3: 29. 1836.

Bumelia syderoxyloides Hort. ex Lavallée, Arb. Segrez. 160. 1877, *nomen nudum.*

Bumelia undulata Raf. New Fl. N. Am. 3: 28. 1836.

List of Collectors and Exsiccatae

Collector's numbers are printed in *italics;* or, when specimens are not numbered, they are indicated by a dash. Numerals in parentheses represent numbers assigned to species in this revision.

Ames, J. S. — (10); —, —, —, — (14).
Anders, W. H., Jr. — (9).
Andrews, D. M. *20* (1b).

Baker, C. H. *504, 505, 506, 507, 508, 509, 510, 511a,b,z, 512a,b,z, 513, 514, 515, 525, 544* (3); *503* (4); *516* (10).
Ball, C. R. *528* (9).
Barkley, F. A. — (12).
Bartram, E. B. *2425* (1b).
Beck, L. C. — (1).
Bessey, E. A. *2* (10).
Beyrich, C. — (1b); — (5).
Bigelow, J. M. *678* (1b); — (12).
Biltmore Hb. *1688* (1); *1689b,c* (8); *1689a* (8a).
Black, W. C. *757* (1b).
Blodgett, J. L. — (14).
Blumer, J. C. *2298* (2).
Bogue, E. E. — (1b).
Boon, E. —, — (1b).
Boykin, S. — (8).
Braner, W. N. — (1b).
Brigham, J. *11* (1b).
Britton, N. L. *218, 219* (10); *508, 509* (14).
Brown, C. A. *6869, 6872* (1b); *6041, 6287* (9).
Buckley, S. B. —, —, — (1a); — (2); —(3); *19*, — (8); —, — (12); —, —, — (14).
Bull, R. *248* (1b).
Bush, B. F. *1, 2, 3, 210, 226, 802, 877, 1427, 1524* (1a); *171, 182, 236, 262, 491, 704, 905, 956, 1138, 1619, 3130, 4978, 9266, 10148, 10390, 10390a, 13470, 13596, 13628, 13654, 13691, 13893* (1b); *141, 945, 6866* (9).

Cabell, P. H. — (1).
Carpenter, W. M. *19* (9).
Chandler, H. P. *7088* (14).
Chapman, A. W. — (1); — (10); *14*, — (14).
Chickering, J. W., Jr. — (8a).
Clark, R. B. & H. B. Parks. *567, 574* (1a).
—— & J. W. Williams. *510* (12).
Clemens, Mr. & Mrs. J. *889* (2); *891, 893* (12).
Clover, E. U. *181, 1372, 1599* (14).
Cocks, R. S. — (1); — (1b); — (8); — (8b).
Copes, Mrs. H., Jr. — (9).
Cory, V. L. *5770, 11618* (1a); *13227, 13369* (1b); *9761, 9763, 11278, 11279, 12925, 12926, 15315, 15629, 19343*, — (12); *11555, 11617, 16901, 17076, 20566* (14).
Cutler, H. C. *858* (1a).
Curtiss, A. H. *35, 1762*, in part (1); *1762'* (3); *1764*, — (4); *1762*, in part, *4362, 5678* (5); *1761*, in part (8); — (8a); *1761*, in part (8b); *1761*, in part, *6656, 6690* (10); *503, 1765, 1765*, — (14).

Deam, C. C. *16602* (8a).
Demaree, D. *99, 4563, 4614, 5294, 8496, 8716, 9561, 10017, 13180, 16100, 19281* (1b); *3532, 3728, 4235, 18967* (9).
Demetrio, C. H. *47* (1b).
Dickson, D. — (1b).
Dixon, R. A. *403* (1a).
Drake, D. — (8).
Drummond, T. *207*, in part (1b); *207*, in part (9).

Earle, F. S. — (8).
Eastwood, A. *8164* (2).
Eaton, A. A. *444* (14).
Eggert, H. —, — (1a); —, —, —, —, —, — (1b); —, — (8); — (12).
Eggleston, W. W. *16729* (12).
Emig, W. H. *658* (1b).
Engelmann, G. *53*, — (1b).

Featherman, A. *95* (9).
Felkner, W. O. *11* (1b).
Fendler, A. — (9).
Ferguson, A. M. — (10).
Fernald, M. L. & L. Griscom. *4492* (8a).
——, —— & B. Long. *4688* (8a).
—— & B. Long. *4987, 4988, 9393* (8a).
Ferris, R. S. & C. D. Duncan. *2919* (12).
Fisher, A. K. — (2).
Fisher, G. L. — (1a); *54* (10).
Fredholm, A. *5345* (5); *5832* (10).

Garber, A. P. — (4); *24*, —, — (10); — (13); *25* (14).
Gattinger, A. —, — (8b).
Gillespie, J. W. *4956* (1).
Glatfelter Hb. *308* (1b).
Gleason, H. A. — (1b).
Greenman, J. M. *3898* (1b).
Griffiths, D. *6424* (14).
Grimes, E. J. *4269* (8a).

Hale, J. — (1b); —, — (9); — (10).
Hall, E. *394* (1a).
Hanson, H. C. *336, 451* (14).
Harbison, T. G. *3, 6, 7, 12, 14, 14, 15, 16, 23, 27, 29, 96, 829, 1095, 1111, 1127, 1216* (1); *8, 9, 9, 29, 37* (3); *2, 3, 4, 4, 5, 6, 9, 10, 10, 26, 1222, 7051a* (5); *47, 51, 61, 64, 97* (6); *10, 34, 36, 94, 95, 140* (8); *2, 3, 28, 104, 108, 119, 123, 1503* (10); *1357, 1358* (11).
Harper, R. M. *1153* (1); *365, 1100* (8); *110* (10).
Harris, J. A. *C19598, C21149A* (8); *C19999* (14).
Harshberger, J. W. — (10).
Hart, F. P. — (1b).
Harvey, F. L. — (1b).
Hasse, H. E. — (1b).
Heller, A. A. *1938* (12).
—— & E. G. Heller. *4242* (1b).
Hitchcock, A. S. — (1b); — (3); *199* (10).
Holmes, J. S. — (2).
Hopkins, M. *1187, 2108, 2750* (1b).
—— & G. L. Cross. *2543* (1b).
Howell, A. H. *1146* (14).

Jack, J. G. *3026* (1).
Jackson, H. H. I. *340* (1b).
Jeffrey, A. A. *307* (1b).
Jeffrey, L. — (1b).
Jermy, G. *83, 117* (12).

Kellogg, J. H. *388* (1b).

Langlois, A. B. *45*, — (9).
Leavenworth, M. — (14).
Lemmon, J. G. *200* (2).
Letterman, G. W. —, —, — (1b); — (9); *287* (11).
Lindheimer, F. *90, 269* or *979*, —, — (1a); *199* (12).
Little, E. L., Jr. *477* (1b).

Mackenson, B. — (1a); *5* (12).
Mackenzie, K. K. *392* (1b).
Marlatt, C. S. — (1a).
Maxon, W. R. *10926* (14).
McAtee, W. L. *1212* (8).
McFarland, F. T., H. T. Shacklette & L. Plymale. *43* (8).
McFarlin, J. B. *6678* (3).
McKee & Wesley. *3834* (1a).
McKelvey, S. D. *605* (2).
Mearns, E. A. *2351, 2356, 2545* (2).
Mellichamp, J. H. — (5); — (8); — (8a).
Merrill, G. M. *88, 908, 1724* (1b).
Metz, Sister M. C. *419* (12).
Meyer, T. — (1b).
Michaux, A. — (1); — (10).
Mohr, C. *47* (1); *12, 623* (1a); — (8); — (8b).
Moldenke, H. N. *5780* (14).

Nash, G. V. *2167* (1); *818* (3); *1662* (5); *1261* (10).
Nuttall, T. — (1b); — (10).
N. Y. State College of Forestry, Proj. I. *8269* (1a); *8334* (5).

O'Neill, H. — (3); — (8).

Palmer, E. J. *35301, 38474, 38653* (1); *4902, 4943, 5050, 6741, 9104, 9209, 9734, 11242, 11456, 11739, 11844, 13131, 13446, 14176, 14266* (1a); *28, 927, 2655, 4264, 4585, 4641, 5262, 5491, 5772, 5857, 5860, 5862, 5915, 6113, 6330, 6416, 6917, 7468, 7699, 7892, 7894, 8022, 8266, 8267, 8308, 8389, 8536, 8763, 10536, 11198, 11927, 12559, 13226, 14273, 14291, 14328, 14360,*

14610, 14660, 14664, 15723, 18055, 18318, 18483, 19390, 20472, 20556, 20826, 20884, 21160, 21244, 21982, 22030, 22072, 22107, 22642, 22730, 22860, 22929, 23015, 23083, 23366, 24165, 24314, 24601, 24749, 25339, 26136, 26316, 26565, 26980, 28931, 29075, 30067, 30148, 30172, 31622, 31639, 32819, 34761, 35533, 35553, 35595, 35646, 35956, 35983, 36769, 39220, 39227, 39231, 39504, 41809, 41927 (1b); 11367 (2); 27385, 27438, 38350, 38366 (3); 14930, 15078, 15376, 15473, 16583, 17263, 17579, 17731, 17749, 17863, 22506, 23703, 23776, 27205, 35353, 35496, 38459, 38935 (8); 42448 (8a); 26649 (8b); 5067, 6690, 12722, 13084, 26725, 35532 (9); 27301, 35266, 38429, 38471, 38484 (10); 9840, 9937, 10007, 10057, 10148, 10203, 10257, 10322, 10355, 10360, 10386, 10818, 10913, 10975, 11063, 11226, 11321, 11347, 11545, 11599, 11810, 11888, 11899, 12187, 12207, 12208, 12208a, 12210, 12229a, 12270, 12426, 12431, 12483, 13051, 13066, 13525, 13637, 13648, 13678, 13679, 13787, 14246, 14522, 14523, 29539, 29567, 33442, 33489, 33973 (12); 11230 (14).

—— & J. A. Steyermark. 41399 (1b).

Palmer, Edw. 156, 232 (2); 326 (3).

Parker, C. M. 4791 (1a).

Parks, H. B. — (1a); —, — (14).

—— & V. L. Cory. 7791 (1a); 13368 (1b); 6271 (2); 9762, 12926, 15314, 18702, 23871 (12); 11555, 11617, 16900, 20565 (14).

Peebles, R. H. 11698 (2).

——, G. J. Harrison & T. H. Kearney. 388 (2).

Penfound, W. T. — (1); — (9); — (14).

Pennell, F. W. 9581 (14).

Pollard, C. L. 1336 (8b).

Price, S. F. — (8).

Pringle, C. G. — (2); 2787 (14).

Ravenel, H. W. — (5).

Rehder, A. 898 (10).

Reverchon, J. 384, 590, 3194, 3867, —, — (1a); —, — (1b); 97, 1555, 3868 (12).

Riddell, J. L. —, — (9).

Rolfs, P. H. 46 (3).

Rose, J. N. 18047 (14).

—— & P. G. Russell. 24190, 24190a (14).

Rugel, F. 161 (3); 320 (5); — (8); 101 (10); 86, 87, 132, 174 (14).

Runyon, R. 252 (14).

Ruth, A. 202 (1a).

Rydberg, P. A. & R. Imler. 317 (1b).

Sargent, C. S. —, —, —, —, — (1a); — (1b); 6866 (9); —, —, — (14).

Saurman, B. F. — (1).

Schostag, E. L. 3002 (1a).

Schott, A. 69½ (14).

Schulz, E. D. 49, 2434 (1a); 36 (2); 108, 482 (14).

Seibert, R. J. 1412, 1412a (1); 1411 (4); 1386, 1392 (10); 1236, 1276, 1311 (14).

Shacklette, H. T. 440-b (8).

Short, C. W. — (8).

Shreve, F. 5382 (2).

Simpson, C. T. —, —, — (14).

Simpson, J. H. 578 (3); 276, 364 (14).

Small, J. K. — (1); — (8); 7751, — (10).

—— & J. J. Carter. 1469, 2912, 2986, 2987, 2988, 2988a (10).

——, —— & G. K. Small. 3406, 3500 (10).

—— & J. B. DeWinkeler. 9042, 9965 (3).

—— & C. A. Mosier. 6400 (10).

——, —— & J. B. DeWinkeler. 10897, 10944 (10).

—— & E. W. Small. 4909 (14).

——, K. W. Small & J. B. DeWinkeler. 10755 (3).

——, J. W. Small & J. B. DeWinkeler. 10666 (3); 11537 (10).

—— & E. T. Wherry. 11889 (14).

—— & P. Wilson. 1852 (10).

Spears, W. L. 113 (1b).

Stacy, H. I. 107 (1b).

Standley, J. P. 154 (10).

Standley, P. C. 12808 (14).

Stevens, G. W. 1261½, 1720, 2154, 2628, 2960-E (1b).

Steyermark, J. A. 1270, 1492, 11641, 11888, 13181, 13479, 13630, 13737, 14693, 14758, 15964, 20237, 22991, 24108, 26076 (1b).

Stott, A. G. — (8).

Sudworth, G. B. — (1a); — (2).

Swallow, G. C. — (9).

Tharp, B. C. 1424, 1431, —, —, —, — (1a); 3218 (9); 1419, 1550, 1664, 5936, —, — (14).

Toumey, J. W. — (2).
Tracy, S. M. *7464* (1); *3289* (8); *2009* (8b).
Trelease, W. *426, 427, 428, 429, 430, 431, 432, 433, 1116, 1117* (1b).
Tucker, J. G. — (14).

Vasey, G. — (8).

Walker, Mrs. E. J. *17819* (14).
Walter, T. — (5); — (8).
Ward, L. F. — (1a).
Ware, N. A. — (7).
Webber, H. J. *467* (5).
Whitehead, C. R. — (1b).
Whitehouse, E. — (1b).
Wiegand, K. M. & W. E. Manning. *2486* (1); *2487* (11).
Williamson, C. S. *111* (8).
Wilson, P. *8317* (14).
Wolf, C. B. *2580* (2).
Wooton, E. O. — (2).
Wright, C. *422, 1434* (12).
Wurzlow, E. C. — (9).

York, H. H. — (2).

INDEX TO SPECIES

New names, varieties and combinations are printed in **bold-face** type, synonyms are in *italics*, while valid names appear in Roman type.

MONOGRAPH OF MALVAVISCUS[1]

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Introduction

In the plant kingdom there are certain families which are quite distinctive but with very indefinite generic bounds, the Malvaceae being one such family. For example, two species have been included in *Malvaviscus* which intergrade with *Pavonia* and which would better be placed in the latter genus. The same is true in other genera of the family as Kearney[2] found to be the case in *Sphaeralcea.* And when a taxonomist comes to consider specific and subspecific delimitation within *Malvaviscus,* he finds himself in the midst of an unmanageable and indefinable maze of incipient taxonomic entities. This can be attested to by the fact that no comprehensive work has been done in the genus since its establishment almost 200 years ago.

The situation is exemplified by the *Malvaviscus arboreus* complex where there is no constant character of taxonomic value. There is tremendous variation, even with separate branches on the same plant. In Panama, within an area of a few hundred meters, plants with 2, 3, 4, or 5 calyx lobes were found; with short or long involucre lobes; with excurrent rows of hair on the stem or without hair; etc. As a result of such manifest variation, innumerable species have been described, with descriptions based on a single specimen. If this were to be the general practice there would be almost as many species of *Malvaviscus* as there are specimens, since almost every specimen collected differs from all others at least to some slight degree. Thus in a taxonomic treatment of the genus two alternatives exist: excessive splitting into innumerable indistinct and undefinable "species," or lumping into few well-marked species with varietal classification for those groups which are distinct at their extremes but do intergrade with all or most other groups.

[1] An investigation carried out at the Missouri Botanical Garden in the Graduate Laboratory of the Henry Shaw School of Botany of Washington University and submitted as a thesis in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

[2] Kearney, T. H., in Univ. Calif. Pub. Bot. **19**: 1–128, *pl. 1–12, 1 fig.* 1935.

Issued September 18, 1942.

For the conscientious taxonomist there is no middle course in this genus, for if these intergrading types are to be considered as worthy of specific rank, surely the "good" or distinct species, obviously of higher degree difference even to the most casual observer, merit generic rank. It is my opinion that the second or "lumping" alternative is the only acceptable one, both from a scientific and a practical standpoint.

History of the Genus

Being a showy and conspicuous plant, *Malvaviscus* has been recognized, under one name or another, for centuries. One of the first names under which this genus was included was *Alcea* of Plukenet. Sloane, Tournefort, Plumier, and others placed it in *Malva,* and Linnaeus in *Hibiscus.* Earlier, Hernandez suggested a close relationship with *Althaea,* but used the Aztec name "Atlat Zopillin" in his writing; however, Petiver in 1704 used *Althaea* in a polynomial description for a species of *Malvaviscus* (fide Dillenius).

In 1732 Dillenius proposed the name *Malvaviscus* as distinct from *Malva,* but still used it in a polynomial form as: "Malvaviscus arborescens, flore miniato clauso." He recognized that this new name was synonymous with *Alcea* (in part) of Plukenet, Petiver's "Althaea americana coccinea, flore clauso," and the Aztec "Atlat Zopillin."

Although Linnaeus in 1753 included *Malvaviscus* in *Hibiscus,* Adanson in 1763 and Cavanilles in 1787 accepted *Malvaviscus* as a valid genus in the binomial sense. But in 1788 Swartz proposed to rename the genus *Achania,* a name recognized only by a few authors of the early 19th century. In 1824 A. P. de Candolle divided *Malvaviscus* into two sections, one of which he called *Achania,* the other, *Anotea;* the latter was raised to generic rank by Kunth in 1846, but evidently it should be included in *Pavonia.* During the last century *Malvaviscus* has been generally recognized as a valid genus synonymous with the section *Achania* of de Candolle and doubtfully synonymous with de Candolle's other section, *Anotea.*

Previous Work on the Malvaceae

In the Malvaceae, as a whole, little recent taxonomic work has been done. Kearney[3] monographed the North American species

[3] loc. cit. 1935.

of *Sphaeralcea.* Roush[4] monographed *Sidalcea* and also published a synopsis of *Robinsonella.*[5] Earlier in the century Fries[6] presented a monographic treatment of *Wissadula* and *Pseudabutilon,* Hill[7] published on the acaulescent species of *Malvastrum,* and Hochreutiner[8] offered a monograph of *Anoda.* In 1907 Watt[9] published a book which included a revision of *Gossypium,* and in 1900 appeared Hochreutiner's revision of *Hibiscus.*[10]

However, previous to the turn of the century, monographic treatment of genera in the Malvaceae seems scarcely to have been attempted, although numerous non-monographic publications had appeared, some of first-rank importance. Cavanilles published on *Sida;* Garcke on *Pavonia, Abutilon, Malvastrum,* etc.; Schumann and Gürcke on Malvaceae in Martius' 'Flora Brasiliensis' and elsewhere; E. G. Baker on a synopsis of the Malveae; Bentham on a key to the Malvaceae and Sterculiaceae; Gray and Robinson on Malvaceae of North America. References to these and many other important systematic publications on the Malvaceae can be found in the 'Bradley Bibliography'[11] and in other bibliographies.

Non-taxonomic studies on Malvaceous genera have appeared rather frequently. Because of its economic importance, *Gossypium* has been the subject of many investigations, especially along cytogenetic and anatomical lines, and probably ten times as much literature has been published concerning this genus as all other genera of the Malvaceae combined. However, the bast fiber production in *Sida* and other genera, the virus transmission in *Abutilon,* photoperiodism and embryological development in several genera, and ecological studies involving certain Malvaceae have been the subjects of numerous recent investigations. Then too, chromosome counts have been made in almost all genera of the family and about 15 per cent of the species. Nor can we fail to notice the continuous use of certain species in horticultural work.

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[4] Roush, Eva M., in Ann. Mo. Bot. Gard. **18**: 117–244. 1931.

[5] Jour. Arnold Arb. **12**: 49–59, *7 figs.* 1931.

[6] Fries, R. E., in Kgl. Svenska Vet. Handl. **43**: 1–114, *10 pls.* 1908.

[7] Hill, H. W., in Jour. Linn. Soc. Bot. **39**: 216–230. 1909.

[8] Hochreutiner, B. P. G., in Ann. Cons. & Jard. Bot. Genève **20**: 29–68. 1916.

[9] Watt, G. The Wild and Cultivated Cotton Plants of the World. 406 pp. 1907.

[10] Ann. Cons. & Jard. Bot. Genève **4**: 23–191, *9 figs.* 1900.

[11] Rehder, A. The Bradley Bibliography. **2**[2]: 518–528. Arnold Arb. Pub. 3. 1912.

Morphology of Malvaviscus

The genus *Malvaviscus* consists of woody perennial plants that may be shrub-like or vine-like, clambering or suberect. Roots are of the tap-root type, fairly thick, often twisted and distorted. Stems are terete, woody, and, although moderately stout, are unable to support the mature plant erect; they branch freely, bear many leaves, are green and generally stellate-pubescent when young, but become glabrous or subglabrous and gray-brown with age. Branches neither twine nor possess tendrils, vine-like specimens merely clambering upon available support.

The leaves are alternate, stipulate, petiolate. The blade is moderately thick, broadly ovate-cordate to linear-lanceolate, unlobed to palmatifid, deeply serrate to subentire. The pubescence of the blade varies, consisting of stellate or straight hairs or a mixture of the two on the upper surface, of more abundant stellate hairs on the lower surface; or the blade may be glabrous in age (pl. 16, figs. 2, 3, 4). Stellate hairs may be appressed to erect, few or many-rayed, large and coarse or small and fine, or a mixture of the types may occur. Venation is prominent, reticulate, usually consisting of five larger veins with numerous anastomosing lateral veinlets. The petiole is variable in length, uniformly pubescent, with a ridge of hair (often decurrent on the stem), or glabrous. Stipules are linear-lanceolate, about 7 mm. long, caducous and usually missing in herbarium material.

The inflorescence is a few-flowered, terminal or subterminal cyme, or flowers may occur singly or in groups in the axils of leaves. Usually there is a combination of these types, the young branch being itself a leafy "inflorescence." The pedicels are relatively short, scarcely ever as long as the flower, pubescent like the petiole, and usually more or less aggregated. Flowers are small to large in the *Malvaviscus arboreus* complex (1.5–5.5 cm. long),[12] very large in *Malvaviscus candidus* (about 8 cm. long), and are generally very showy, but not fragrant. They never open fully but remain as a contorted tube, each petal overlapping the next. The mature staminal column is exserted about one third its length beyond the petals.

The involucre (pl. 17, fig. 4), often designated as subcalyx or involucel, is conspicuous, more or less enclosing and hiding the calyx. It is usually densely pubescent with small stellate hairs, sometimes

[12] In this monograph flower length indicates the distance from the base of the calyx to the tip of the petals, disregarding the exserted staminal column.

subglabrous. The involucral lobes are entire, linear to broadly lanceolate or obovate, varying in number (8 is a common number), and usually about as long as the calyx. They are attached to the pedicel immediately below the calyx and are persistent until maturity of the fruit.

The calyx (pl. 17, fig. 1) is campanulate, usually uniformly and densely stellate-pubescent without, sometimes subglabrous or with longitudinal ridges of hairs. On the inside it is short-lanose near the tips of the lobes, sub-lepidote below. The lobes are variable in number (generally five), essentially deltoid-lanceolate, and are usually unequal in size. The persistent calyx may or more often may not entirely enclose the mature fruit.

The petals (pl. 17, fig. 2) are five in number, asymmetrically obovate-cuneate, usually emarginate at the top, unguiculate toward the base and uncinate-auriculate on one side of the claw. On the outside they are slightly stellate-pubescent basally or subglabrous.

The thin, glabrous, staminal column (pl. 17, fig. 3) is usually one-third longer than the corolla and is five-lobed apically. The many unilocular, oval anthers are borne towards the tip on short filaments. From the top of the staminal column are exserted ten style branches, each with a capitate stigma. The ovary appears as a swelling at the base of the staminal column and is sessile, five-carpellate, five-ovulate.

The fruit (pl. 17, fig. 5) is depressed-globose, medium-sized in the *Malvaviscus arboreus* complex, but larger in *Malvaviscus candidus*. It consists of five stone-like, one-seeded carpels enclosed by a fleshy covering which soon dries, allowing the carpels to separate easily. A small reniform, basally attached seed is found in each carpel. Often only two or three of the carpels of the fruit mature.

Of the morphological characters, few seem to be of diagnostic value. The habit of the plant seems to vary with the environment, as does to some extent the type of inflorescence. The structure of branch, petiole, and pedicel is essentially uniform in the genus, as is the type of stipule. The internal structure of the flower is also essentially uniform throughout the *Malvaviscus arboreus* complex, just as it is, for example, in the Cruciferae, and is of little value for taxonomic delimitation within *Malvaviscus arboreus*. In addition, many herbarium sheets of *Malvaviscus* are with but one or two flowers, the removal and boiling of which would leave little critical flower material for the next observer. Also the type of fruit differs

significantly only between the *Malvaviscus arboreus* complex and *Malvaviscus candidus,* two species which are already amply separated on other characters. Moreover, herbarium specimens of *Malvaviscus* rarely contain fruit, and it would be impractical and unwise to base taxonomic units on this character unless absolutely necessary for a natural classification. The form of the involucre and of calyx is variable even on flowers of the same plant and is of taxonomic value only in a limited way. Similarly, type of leaf margin and structure of the staminal column offer little critical evidence to the taxonomist.

However, the fundamental difference in leaf shape, the type and degree of pubescence (in part), and the size of the flower seem to offer a broad basis for taxonomic segregation. Yet there is not a single character in the genus that by itself is of constant value for critical delimitation within the *Malvaviscus arboreus* complex.

TAXONOMIC RELATIONSHIPS AND SUGGESTED GENERIC CHANGES

Delimitation of taxonomic groups: The Malvaceae belong, of course, to the order Malvales of the Polypetalae. There has been great diversity of opinion as to how many families should be recognized in this order, from two to nine distinct families having been accepted by various authorities. However, since the early eighteen-hundreds the family Malvaceae has been distinct and generally recognized as an entity with essentially its modern limits, defined especially by the presence of unilocular anthers and monadelphous staminal column.

Within the Malvaceae subfamilies, tribes, and subtribes have been recognized chiefly on the basis of fruit characters. Perhaps the most useful and generally accepted division of the family is that of Gray,[13] in which he recognized, on the basis of number and arrangement of carpels, mode of dehiscence of the fruit, and morphology of the staminal column, four tribes: the Malopeae, Malveae, Ureneae, and Hibisceae. The tribe Ureneae, of which *Malvaviscus* is a member, is distinguished by having five uniovulate carpels, ten style-branches, the staminal column antheriferous along the upper part (but not at the truncate or five-toothed summit), and the seeds ascending, with a superior radicle. Among the genera included in this tribe are *Malachra, Urena, Pavonia,* and *Malvaviscus. Malvaviscus* is distinguished from the other genera

[13] Syn. Fl. N. Am. 1^1: 294–338. 1897.

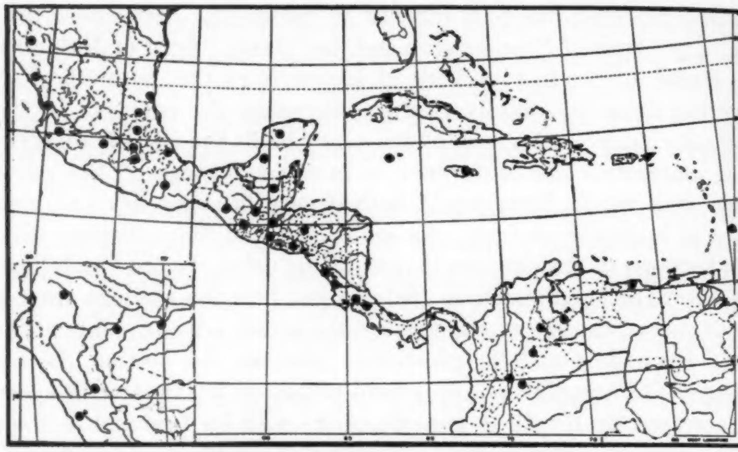
in having a "fleshy" or "drupaceous" fruit. However, the genus is apparently as closely related to *Pavonia* as are the "dry-fruit" genera of the Ureneae to one another.

Proposed generic changes: The dividing line between *Malvaviscus* and *Pavonia* has been difficult to recognize. Just where does the "dry" fruit of *Pavonia* stop and the "fleshy" fruit of *Malvaviscus* start? In the mature fruit of *Malvaviscus* the outer "fleshy" covering dries and finally ruptures exposing the carpels. In *Pavonia* the "dry" outer wall of the ovary holds the carpels together until maturity. The difference is in the thickness of the outer ovary wall which, however, in both genera becomes dry and ruptures at maturity of fruit. An additional and more distinct division between the two genera is possible by using the old Candollean character for subdivision of *Malvaviscus* into the sections *Anotea* and *Achania,* namely whether or not the petals are auriculate at the base. Even de Candolle questioned whether the section *Anotea* belonged in *Malvaviscus.* It is here proposed to transfer this section (raised by Kunth to generic rank) with its few and in some cases unrecognizable species to *Pavonia.* Thus *Pavonia* will include species without auriculate petals while *Malvaviscus* will include only those species with auriculate petals. This will necessitate the transfer of but two undoubted species of *Malvaviscus* to *Pavonia,* both of which evidently should be transferred anyway on fruit character alone. Thus *Malvaviscus Palmeri* Baker f. *(Malvaviscus cinereus* Baker ex Robins. & Greenm., *Pavonia amplifolia* Standl.) should be *Pavonia Palmeri* (Baker) Schery, and specimens heretofore incorrectly determined "ex char." as *Malvaviscus acerifolius* Presl should be *Pavonia firmiflora* Schery n.sp. Both of these species have a "dry" fruit as well as non-auriculate petals. They are treated in this monograph as excluded species.

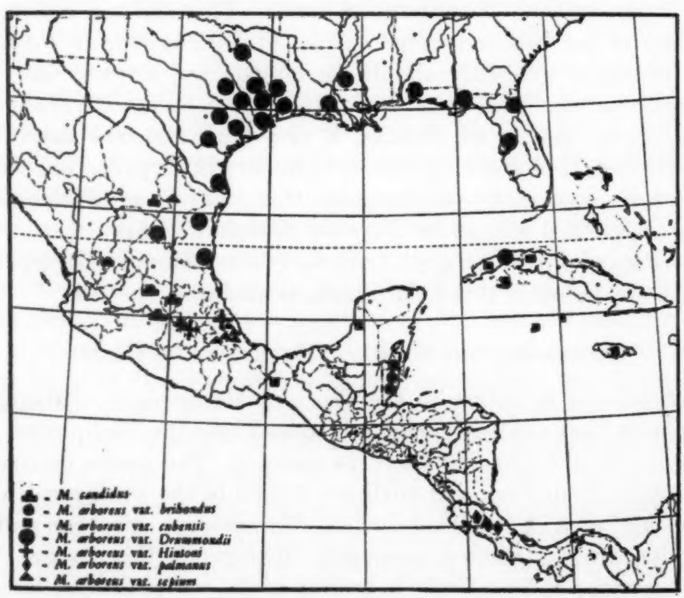
Geographic and Climatic Range of the Genus

Malvaviscus is native to the Western Hemisphere, although a few plants have evidently been introduced into the Philippines and Malaya and are growing there as escapes. The genus occurs indigenously from Peru and northern Brazil to the southern United States and also in the West Indies. *Malvaviscus arboreus* and its varieties are distributed generally throughout this range. The other species are found only in limited areas, one in central Mexico, another in Brazil. *Pavonia firmiflora* and *Pavonia Palmeri* (heretofore included in *Malvaviscus)* are confined to western Mexico.

Maps 1–6 show the present known distribution of the species and varieties of *Malvaviscus* and of the two above-mentioned species of *Pavonia*. It is interesting to note that certain groups have be-

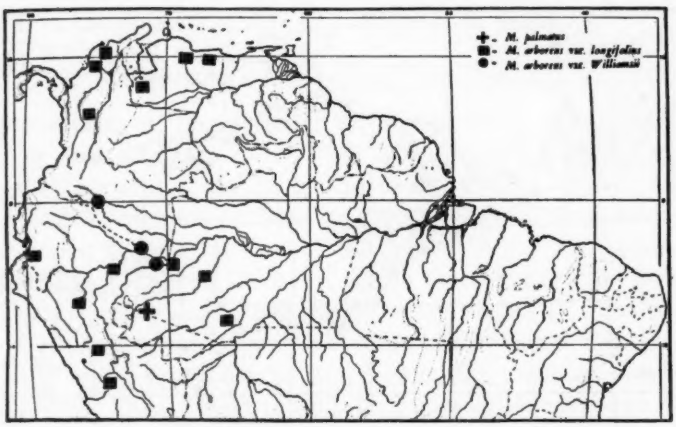


Map 1. Showing distribution of *M. arboreus*.

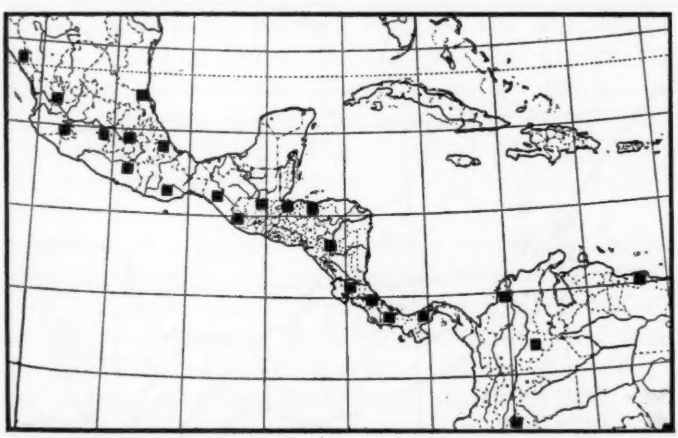


Map 2. Showing distribution of *M. candidus* and *M. arboreus* vars. *brihondus*, *cubensis*, *Drummondii*, *Hintoni*, *palmanus* and *sepium*.

come locally segregated and divergent enough to warrant varietal classification (vars. *palmanus, brihondus, sepium, Hintoni,* etc.), while others are very widespread, overlapping, and more or less



Map 3. Northern South America showing distribution of *M. palmatus* and *M. arboreus* vars. *longifolius* and *Williamsii.*

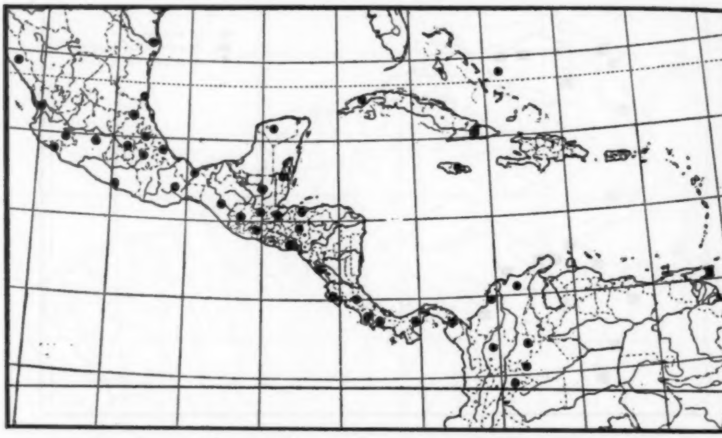


Map 4. Showing distribution of *M. arboreus* var. *penduliflorus.*

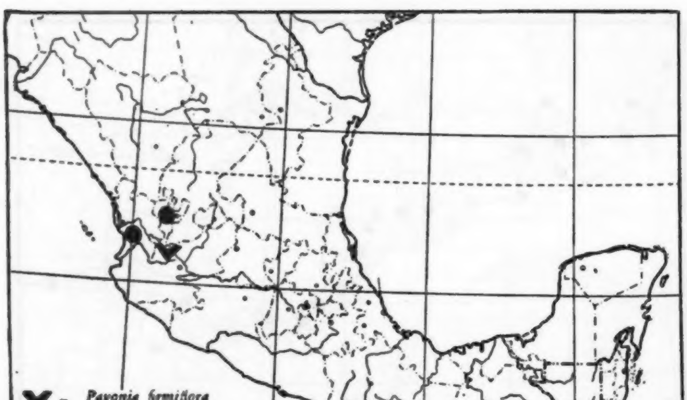
artificially delimited, evidently the parent stock from which local segregations are occurring (*Malvaviscus arboreus* and vars. *penduliflorus, mexicanus,* etc.).

Malvaviscus is quite tolerant of geographic-climatic differences. It is found growing from near sea-level to highlands of 2500 meters

as, for example, in Panama, where plants can be found within sight of mangrove swamps (Puerto Armuelles) while about a hundred kilometers towards the interior it is abundant near the lower slopes



Map 5. Showing distribution of *M. arboreus* var. *mexicanus*.



Map. 6. Map of Mexico showing distribution of *P. firmiflora and P. Palmeri.*

of Volcan de Chiriquí. In Mexico the genus is found in the hot, steaming forests of the Tehuantepec Peninsula and the high, cool plateau region near Mexico City. Plants of northwest Mexico and Texas grow in open semi-arid regions (damp river bottoms, etc.)

while those of Costa Rica and Panama may occur in dense rain-forests. Apparently there are ample geographic-climatic forces pressing for speciation. That these forces have had relatively little effect (in the sense of forming distinct, isolated species) testifies again as to the plasticity and variability of the genus.

Evidence for Taxonomic Conclusions

Study of natural populations: In *Malvaviscus,* populations, in the sense that the term is used for dense, isolated groupings or clusters of herbs and shrubs in the United States, do not occur. Rather, whole regions, perhaps several kilometers in extent, are found in the tropics where the plants are relatively abundant. Scarcely ever more than three or four separate plants grow side by side, and numerous single individuals occur frequently. The plants trail over shrubbery, are more or less shrub-like in open areas, and frequently in the forest can be found liana-like reaching almost to the tops of the trees. A single plant may spread over an area seven or eight meters in diameter and perhaps overlap partly the area occupied by another *Malvaviscus.*

In no case have I found hundreds of *Malvaviscus* plants within a small area, able to be collected, analyzed and counted, as are many North American plants used in population studies. Nevertheless, in areas even kilometers in extent, as, for example, moist stream banks, it seems plausible to assume that all the plants of this genus are apt to be rather closely related inasmuch as it may be tens or even hundreds of kilometers before another such area is encountered.

Examination of a young stem in flower from every accessible plant in such an area in Chiriquí, Panama, showed that a general similarity in certain characters existed (viz. general leaf shape; broader structural features of calyx, corolla, etc.), but that tremendous individual variation in certain specific characters (viz. number, length, and shape of calyx and involucre lobes, type of serration of leaf, continuity of pubescence, etc.) was also evident. It is not hard to imagine that a taxonomist unfamiliar with the genus, given two extremes from the "population," might consider the specimens as different species. Yet all intergrading degrees of variation exist, sometimes even on the same plant. The only conclusion that seems tenable is that individuals of *Malvaviscus* exhibit great variability, whether due to ploidy, hybridization, or other causes. Photographs of some specimens from this "popula-

tion" are presented in plate 15. Similar examination of a "population area" in Vera Cruz, Mexico, though not as extensive, supported these findings on individual variabilty.

Examination of greenhouse plants: That certain variations in leaf shape are of no taxonomic value (although, as will be shown directly, the manner of variation may be significant) can be shown by examination of living *Malvaviscus* plants. On the same plant from comparable stems can be found both semi-lobed and unlobed leaves. Figure 1 of pl. 16 shows two leaves from a plant which had been growing in the greenhouse of the Missouri Botanical Garden for a number of years. That these greenhouse plants, evidently brought from southern Mexico, had the potentiality for "acting queer" as far as leaf shape is concerned, was demonstrated when cuttings were made and rooted. The first-formed leaves of the cuttings were unlike any leaf ever seen on the parent plant, although genetically parent and scion were the same. However, after about eight or nine nodes, the cuttings developed leaves like the parents. A photograph of one such cutting appears in pl. 14.

Examination of herbarium material: From limited examination of living plants of *Malvaviscus,* it was evident that great variability was to be expected in herbarium material of the genus, and that many of the characters which normally (i.e., in other genera in other families) might be constant and of definite systematic value were worthless here.

Examination of all available herbarium material of *Malvaviscus* shows complete intergradation of all forms in the *Malvaviscus arboreus* complex. Segregation of specimens of different appearance can be accomplished only with overlappings and intergradations. Intense segregation leads to a multitude of intergrading forms all of slightly different appearance (over 100 such segregated forms, all marginally indistinct, are possible in sorting *Malvaviscus* specimens). Obviously such intense segregation is worthless in any genus as variable as *Malvaviscus.* It leads to nothing more than artificial forms to which must continually be added others as more specimens are collected. Keying out of such forms is impossible, even on a distributional basis alone.

Thus in order to find some clear-cut specific characters of taxonomic value in the *Malvaviscus arboreus* complex, individual characteristics were scrutinized separately in a series of specimens ranging from South America to Texas. In approximately 400 specimens examined for distinctive characters in leaf shape, pubescence

TABLE I

NUMBER OF SPECIMENS FROM DIFFERENT LOCALITIES SHOWING CONTRASTING CHARACTERS.

	leaf shape					leaf pub.		pet-iole		stem pub.		involucre lobes			flower length			leaf length			leaf margin			
						stellate	simple	pilose	pubescent	decurrent	continuous	wide	interm.	thin	<3 cm.	3-4.5 cm.	> 4.5 cm.	short	interm.	long	sinuate	dentate	serrate	jagged
Peru	6	2	0	9	0	12	5	10	7	5	12	9	7	0	0	4	8	0	3	14	7	5	1	4
Brazil	3	3	0	0	0	1	2	2	1	0	3	4	2	0	0	2	3	0	0	6	2	0	3	1
Venezuela	3	4	0	1	0	2	5	8	0	4	4	0	2	6	0	4	4	0	4	3	2	1	4	1
Colombia	6	5	0	1	0	8	1	7	3	3	6	1	8	2	0	8	1	0	2	9	2	4	3	1
Panama	10	25	1	1	0	36	1	31	6	21	14	1	13	23	0	28	7	2	16	18	14	14	6	3
Costa Rica	0	16	14	7	2	24	11	34	3	12	24	0	16	19	2	16	13	5	16	15	11	9	11	6
Nicaragua	0	0	3	3	1	1	5	6	0	0	7	0	6	0	3	4	0	1	5	1	4	1	2	0
Honduras	0	13	4	2	0	11	9	18	1	5	15	0	6	15	0	12	7	0	11	9	7	4	3	6
Salvador	0	1	0	1	1	0	3	3	0	0	3	0	0	3	1	2	0	0	3	0	0	3	0	0
Br.Honduras	0	2	11	0	0	13	0	12	2	4	9	0	9	4	12	0	0	3	8	2	1	10	1	1
Guatemala	0	22	14	10	5	30	19	32	13	16	35	1	19	28	10	28	5	8	28	15	10	23	8	10
Yucatan	0	26	4	2	0	29	2	29	3	7	23	4	22	5	25	2	0	9	21	1	4	22	3	0
So. Mexico	0	9	2	4	1	11	5	14	2	10	6	0	11	4	7	6	2	4	11	1	4	10	1	1
West Mexico	0	11	1	2	0	4	10	13	1	6	8	0	5	9	5	7	1	2	5	7	0	12	1	1
Cent.Mexico	1	6	4	9	3	10	13	23	0	11	12		13	9	6	9	4	3	14	6	3	13	7	0
East Mexico	0	17	3	5	0	7	17	23	2	19	6	3	17	5	19	4	1	9	15	1	9	14	1	1
No. Mexico	0	3	0	2	4	1	8	8	1	5	4	0	5	4	6	3	0	3	6	0	1	6	2	0
So. Texas	0	0	0	13	18	3	29	31	0	7	25	0	19	13	24	6	0	3	21	8	2	26	4	0
Cent.Texas	0	0	0	4	18	0	22	21	0	2	20	0	10	12	19	1	0	1	14	7	4	14	4	0

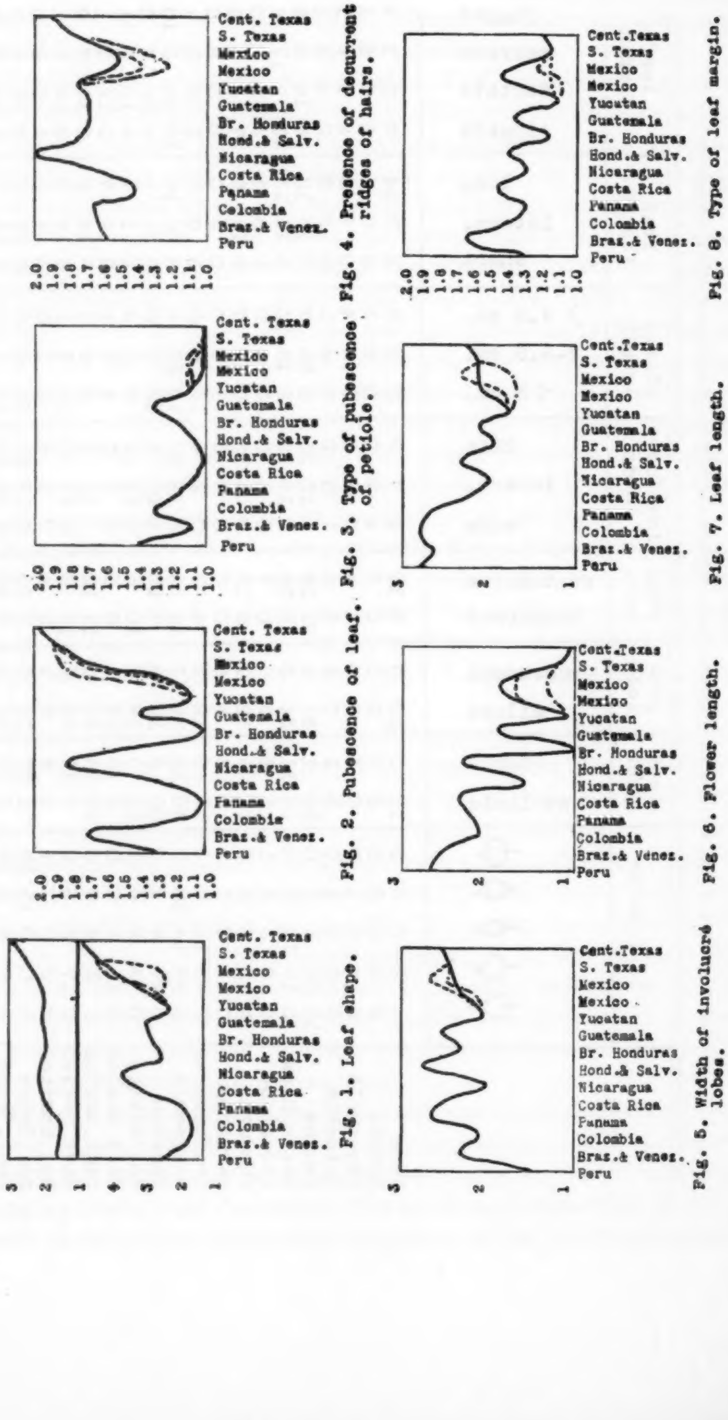


Fig. 1. Leaf shape.

Fig. 2. Pubescence of leaf.

Fig. 3. Type of pubescence of petiole.

Fig. 4. Presence of decurrent ridges of hairs.

Fig. 5. Width of involucre lobes.

Fig. 6. Flower length.

Fig. 7. Leaf length.

Fig. 8. Type of leaf margin.

of leaf, of petiole, and of stem, shape of involucre lobes, length of flower and of leaf, and type of leaf margin, not a single clear-cut difference was found. Later examination dealing with the number of flowers per inflorescence, presence or absence of petiole callus, relative length of the staminal tube, type of venation, pubescence of veins, and concentration of stamens, showed a similar lack of clear-cut characteristics in Panamanian specimens alone.

However, one point of significance was noted about several of these characters: they differed, *on the average,* for specimens from different geographical areas. Thus in Colombia leaves of specimens, by and large, are broad and cordate at the base, whereas in British Honduras "average" leaves are narrow and rounded. Again, flowers in South American specimens, although often the same length as those in Texas specimens, show an *average* length significantly greater than the *average* for Texas flowers.

Table I gives the tabulated results of these examinations, and figs. 1–8 show these results put into graph form for individual characters. Of course the intrinsic value as read from the ordinants of these graphs (geographical distribution read from abscissas) is not significant. These values were obtained in mathematical form by arbitrarily assigning one extreme of a given character a high number, the other extreme a low number. Then an average for all specimens of the region was taken and tabulated. Thus if half the specimens showed the high number character and half the low, the average would be midway between these two. Significance for the character can only be assumed when there is a pronounced rise or dip in the curve at a certain geographical region. For example, reference to figs. 1–8 will show a steep dip or rise for many characters in the region of British Honduras. From this it can be assumed that the available British Honduran specimens are more or less constantly different in many ways from those of neighboring regions and probably constitute a taxonomic unit.

Yet examination of these graphs as a whole shows a remarkable lack of "significant characters" for any one region. Rather, the dips occur indiscriminately for various characters, now in one geographical region now in another. With one or two exceptions, there is no continuous gradation of characters from South America to North America.

These results were assumed to indicate further that in the *Malvaviscus arboreus* complex, there are no clear-cut, distinctly different taxonomic units, at least as far as geographical distribution is con-

cerned. In other words, that although no distributional differences of specific degree existed, perhaps numerous overlapping groups, viz. from British Honduras, Texas, etc., were deserving of varietal separation. Also it seemed that of the characters examined, basic leaf shape and length of flower were perhaps fundamental and would be of value as key characters. The other characters, seemingly, were useless or of limited value. Of course it must be remembered that tabulations and investigations of this kind are apt to show up only degrees of differentiation due to geographical isolation, and may or more probably may not show speciation due to biological isolation. However, in a genus such as *Malvaviscus*, where scarcely a constant character is to be found, any approach that may give a hint as to natural groupings is worth investigation.

Hybridization evidence: In another line of attack on the problem of taxonomy in the *Malvaviscus arboreus* complex, hybridization was attempted between var. *Drummondii* (Texas) and var. *penduliflorus* (southern Mexico?) growing in the Missouri Botanical Garden greenhouses. Although both varieties flower abundantly in the greenhouse, their blooming seasons do not coincide but do partly overlap. Variety *penduliflorus* blooms through the winter, spring and early summer; var. *Drummondii* in the autumn and sporadically at other times. This discrepancy between blooming seasons can be accounted for by the latitudinal season and day-length differences of the regions to which these varieties are indigenous.

Flowers of both varieties were early castrated, hand-pollinated a day or two later with pollen from the other variety, and then bagged (both opaque and translucent paper bags were tried). However, in no case would var. *penduliflorus* flowers set seed, even when self-pollinated. This was evidently due to greenhouse conditions, for greenhousemen cannot recall ever having seen this variety set seed at the Missouri Botanical Garden. Neither did any *Drummondii* flowers pollinated with *penduliflorus* pollen set seed; but so few *Drummondii* flowers were available at the proper time that this result is not significant. Normally, only a very small percentage of *Drummondii* flowers set seed in the greenhouse, even when self-pollinated. Thus from attempted greenhouse hybridizations, no conclusions could be reached as to the closeness of relationship in these two varieties. However, an incidental observation noted in herbarium material seemed to be supported: that there is an inverse relationship between the flower length in *Malvaviscus* and quantity of seed set. Smaller-flowered plants (as var. *Drummondii*) seem

to set more seed than larger-flowered ones (as var. *penduliflorus*), perhaps due to the fact that the pollen tube must push farther through the style in long-flowered types with a consequent lesser chance of reaching the ovary.

Even though no evidence that hybridization is possible in *Malvaviscus* was obtained from the greenhouse experiments, much circumstantial evidence exists that hybridization does occur in the genus. Firstly, many plants are intermediate in character and have never been exactly duplicated in later collections (specimens of *Malvaviscus arboreus, Pavònia firmiflora,* etc.). Secondly, geographic distribution of varieties makes contact possible with many other varieties (extended and overlapping range of *Malvaviscus arboreus* and such varieties as *mexicanus, penduliflorus,* etc.). Thirdly, there is usually a low percentage of flower fertility in living plants (plants examined in the field in Mexico, Costa Rica, and Panama showed that very few fruits matured in proportion to the number of flowers produced). Fourthly, hybridization is evidently not uncommon in the family Malvaceae (Kearney[14] on *Sphaeralcea,* Webber[15] on relationship in *Gossypium,* Skovsted[16] on chromosome numbers in the Malvaceae, etc.). In all probability appropriate experiments by competent geneticists and cytologists would show varietal hybridization to be exceedingly common in *Malvaviscus,* and even intergeneric hybridization with *Pavonia* possible.

Chromosome counts: Lack of proper technique by the author in making microspore chromosome counts, probably more than natural difficulties in the genus, made investigations along this line of no taxonomic value. Aceto-carmine smears of young pollen showed occasional evidence of a great many chromosomes, but these were so abundant, indistinct, and obscured by debris that counts were impossible. However, Skovsted[17] reports the occurrence of a diploid count of 84 chromosomes in *Malvaviscus.* This number fits in with the basic chromosome number of 7 found in the tribe Ureneae, a number Davie[18] would like to consider as basic for the family as a whole but which others (viz., von Kesseler,[19] Webber,[20] Skovsted,[17]

[14] Univ. Calif. Pub. Bot. **19:** 1–128. *pls. 1–12. 1 fig.* 1935.
[15] Webber, J. M., in Jour. Agr. Res. **58:** 237–261. 1939.
[16] Skovsted, A., in Jour. Genet. **31:** 263–296. 1935 *(Malvaviscus,* p. 285); in Compt. Rend. Lab. Carlsberg **23:** 195–242. 1941.
[17] loc. cit. 1935 and 1941.
[18] Davie, J. H., in Jour. Genet. **28:** 33–67, *2 pls.* 1934.
[19] Kesseler, E. von, in Am. Jour. Bot. **19:** 128–130, *pl. 9.* 1932.
[20] Webber, J. M., in Science, N.S. **81:** 639–640. 1935.

Harland,[21] etc.) find unacceptable as ancestral for the entire Malvaceae. Although chromosome counts have scarcely been attempted in *Malvaviscus*, it is to be expected that when such are made a high degree of ploidy, perhaps to the octoploid or decaploid, will be found as in other Malvaceous genera.

Conclusions: From these several lines of investigation a conservative taxonomic treatment for the genus seems necessary. Since clear-cut, stable morphological characters of taxonomic value are lacking, lines of demarcation must necessarily be rather arbitrary and inclusive. Evidently the taxonomy should be made practical as well as following the indistinct varietal groupings as much as possible. Since the pattern of relationships is evidently reticulate through hybridizations rather than linear by descent, a key can only be constructed which may include closely related specimens in all of its main subdivisions. There is bound to be great varietal variability, and often the delimitation of a variety will need be arbitrary. Few groupings will deserve specific rank, since all intergrade and few show any evidence of either biologic or geographic isolation. In short, *Malvaviscus* (i.e. the *Malvaviscus arboreus* complex) seems best pictured as a reticulate background of several intermixing varieties *(Malvaviscus arboreus,* vars. *penduliflorus, mexicanus,* etc.) on which several newer varieties (vars. *palmanus, brihondus, sepium,* etc.) have superimposed themselves locally, perhaps due to a new favorable but non-isolating "mutation."

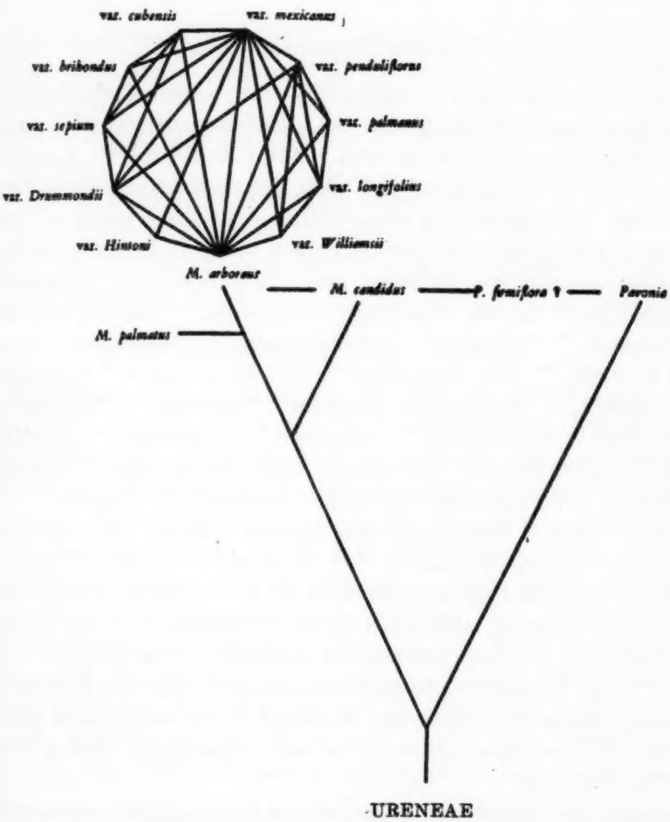
Phylogenetic Inferences

Although it is extremely hazardous to venture phylogenetic opinions, certain hypotheses can be presented regarding relationship of taxonomic groups and their derivation. From the previously mentioned circumstantial evidence concerning *Malvaviscus* and the Malvaceae as a whole, it seems reasonable to suppose that *Malvaviscus* is made up of a number of types, probably polyploid, which have not as yet become genetically isolated (except perhaps, *Malvaviscus candidus)* and are only partially geographically isolated. These types *(Malvaviscus arboreus* and its varieties) have evidently crossed back and forth with one another extremely often. As a result there is a reticulate relationship between *Malvaviscus arboreus* and its varieties, the biggest mixup occurring in southern Mexico. Marginal groups as vars. *Drummondii* in Texas, *Wil-*

[21] Harland, S. C. The Genetics of Cotton. London, Toronto. 1939.

liamsii in Peru, and perhaps *brihondus* of British Honduras and *palmanus* of Costa Rica, are probably the "purest" but nevertheless intergrading types. The promiscuous exchange of characters, possibly coupled with degrees of ploidy, could, at least in part, account for the great variability and intensification of phenotypes even in small populations.

TABLE II



The genus as a whole is closely related to *Pavonia* and may have split off from that genus rather recently. Assuming this to be the case, *Malvaviscus* is in an early stage of speciation within itself, the numerous varieties as yet lacking barriers which would lead to complete speciation. *Malvaviscus candidus* must have been an early segregation from the *Malvaviscus arboreus* complex, perhaps oc-

curring soon after the split with *Pavonia.* The same may be true for *Malvaviscus palmatus,* or this species may be a broadcross hybrid or a monster. Table II represents a possible phylogenetic "tree" for *Malvaviscus.* Actually the figure should be three dimensional with all the *Malvaviscus arboreus* varieties at about the same level. Also it is not intended to show "pure" lineage for the Ureneae, for this tribe in its early stages may have had interconnections with *Hibiscus*-like forms, etc.

Common Names and Uses

Malvaviscus has been recognized by many peoples who have given vernacular names to the plant. As mentioned previously, an early Aztec name for *Malvaviscus* was "Atlat Zopillin."[22] A supposed Maya name is "taman chich." The Maya-Spanish name for the plant was "manzanita," a name still used in many parts of Central America. Other names reportedly used today in Latin America for *M. arboreus* and its varieties are: "algodoncillo," "amapola," "amapolilla," "arete," "arito," "candelillo," "chilito colorado," "chilmecate," "chocho," "claveloncillo," "esbequen blanco," "flor de arito," "flor de avispa," "fucsia silvestre," "manzana," "manzanilla," "manzanita guesillo," "mapola," "monaguillo," "monacillo," "monecillo," "obelisco," "panelita," "papito de monte," "para tisano" (for root), "pico de gorrion," "quesillo," "quesito," "resuscitado de monte [mente?]," "sobon," "tulipancia," "uba," and doubtless several others. *M. candidus* is known as "monacillo blanco." "Waxmallow" and "Turk's-cap Hibiscus" are two English names for *M. arboreus* var. *penduliflorus,* which is frequently cultivated as an ornamental in our southern states where it has been introduced, evidently from Mexico. "Mayapple" is the name given to *Malvaviscus arboreus* var. *Drummondii* in Texas where the fruits are reported to be eaten both raw and cooked. *Malvaviscus arboreus* is also reportedly called "sugar bark" in Jamaica.

Perhaps the reason why *Malvaviscus* has acquired so many local names in Central America is that it is of some economic importance to the natives, and thus attention has been focused on it. Rubbing the head with leaves of the plant supposedly cures scaly head, and

[22] The early Spanish explorer, Francisco Hernandez, who was sent to Mexico by Philip II from 1570 to 1576 as expedition naturalist, records this name in his 'Nova Plantarum, Animalium, Mineralium Mexicanorum Historia,' which was published at Rome in 1651.

a decoction of the leaves is said to be used as a diuretic and in treatment of stomach ailments. Also the fruit of *Malvaviscus* is edible, though scarcely appetizing.

Taxonomy

ABBREVIATIONS USED IN THIS SECTION

A—Arnold Arboretum Harvard University, Jamaica Plain, Massachusetts.

F—Field Museum of Natural History, Chicago, Illinois.

G—Gray Herbarium of Harvard University, Cambridge, Massachusetts.

L—Museo de Historia Natural de la Universidad de Lima, Lima, Peru.

M—Missouri Botanical Garden, St. Louis, Missouri.

NY—New York Botanical Garden, New York City.

US—United States National Herbarium, Smithsonian Institution, Washington, D. C.

MALVAVISCUS [Dill.] Adans.

Malvaviscus [Dill. Hort. Elth. **2**: 210. *pl. 170. fig. 208.* 1732] Adans. Fam. **2**: 399. 1763; Cav. Tert. Diss. Bot. 131. *pl. 48, fig. 1.* 1787; Medic. Malv. 49. 1787; Juss. Gen. Plant. 304. 1791; Moench, Meth. Suppl. 208. 1802; HBK. Nov. Gen. & Sp. **5**: 285. 1821 [1822]; DC. Prodr. **1**: 445. 1824; Descourt. Fl. Ant. **6**: 11. *pl. 383.* 1828; G. Don, Gen. Hist. Dichl. Pl. **1**: 475. 1831; Presl, Reliq. Haenk. **2**: 135. 1835; Endl. Gen. Pl. 982. 1836–40; A. Rich. Bot.—Pl. Vasc., in Sagra, Hist. Nat. Cuba, 131. 1845(?); Gray, Gen. Pl. U. S. 77. *pl. 131.* 1849; Benth. & Hook. Gen. Plant. **1**: 206. 1862; Baill. Hist. Pl. **4**: 148. 1873; Hemsl. Biol. Cent.-Am. Bot. **1**: 118. 1879; K. Schum. in Engl. & Prantl, Nat. Pflanzenfam. **3**^{6}: 46. 1890; Mart. Fl. Bras. **12**^{3}: 535. 1892; Gray, Syn. Fl. N. Am. **1**: 297, 332. 1897; Small, Fl. S.E. U. S. 733. 1913; Standl. in Contr. U. S. Nat. Herb. **23**: 773. 1923.

Hibiscus L. Sp. Pl. **2**: 694. 1753, in part; Browne, Hist. Jam. 284. 1756.

Achania Sw. Prodr. Fl. Ind. Occ. 102. 1788; Ait. Hort. Kew. **2**: 459. 1789; Schreb. in L. Gen. Plant. ed. 8, **2**: 469. 1791; Sw. Fl. Ind. Occ. **2**: 1221. 1800; Willd. in L. Sp. Plant. **3**: 839. 1801; Spreng. in L. Syst. Veg. ed. 16, **3**: 100. 1826.

Pavonia Cav. Ic. **5**: 20. *pl. 434.* 1799, in part; DC. Prodr. **1**: 445. 1824, as syn.

Anotea (DC.) Kth. ex Ulbrich in Fedde's Rep. Spec. Nov. **14**: 108. 1915, as doubtful section in DC. Prodr. **1**: 445. 1824.

Perennial vine-like or shrub-like plants with many-branched gray-brown terete stems. Leaves alternate, stipulate (stipules caducous), petiolate, variously lobed, usually stellate pubescent, especially on lower surface. Inflorescence leafy, with single axillary flowers or with terminal or subterminal cyme-like clusters of flowers. Involucre of 6–16 entire, linear, lanceolate, or spatulate lobes. Calyx campanulate, usually with 5 lanceolate or deltoid lobes, variously pubescent. Corolla contorted, tube-like, never expanded. Petals 5, obovate-cuneate, usually emarginate, unguiculate and auriculate basally. Staminal column exserted, 5-parted apically, bearing many stamens toward the apex. Style branches 10, each with capitate stigma. Ovary 5-carpellate. Fruit with outer fleshy covering (dry at maturity) surrounding five stony carpels. Carpels 1-seeded, indehiscent but often separating at maturity when outer covering dries.

Type species: **Malvaviscus arboreus** Cav. Tert. Diss. Bot. 131, *pl. 48, fig. 1.* 1787.

KEY TO THE SPECIES AND VARIETIES

A. Flower large, petals about 8 cm. long; staminal column about 12–15 cm. long, more or less curved-ascending; filaments about 1 cm. long .... *1. M. candidus*

AA. Flower smaller, petals less than 6 cm. long; staminal column less than 7 cm. long, not curved-ascending; filaments less than 3 mm. long.

B. Leaves palmately or digitately lobed (known only from type description of greenhouse plant) .... *2. M. palmatus*

BB. Leaves less deeply lobed, sublobate, or unlobed, never palmately or digitately lobed.

C. Leaves lobed or sublobate.

D. Lateral lobes of leaves usually manifest and more or less acute; branchlets, petioles or lower leaf-surface very densely hairy, often velvety (occasionally lightly pubescent or hirsute, or almost glabrous, but then lobes of leaves usually large and very prominent); upper leaf-surface usually predominantly stellate-haired; involucral lobes never foliaceous; flowers red .... *3. M. arboreus*

DD. Lateral lobes of leaves obtuse or small; branchlets, petioles and lower leaf-surface variously pubescent but usually not with long dense hairs; plants either with upper leaf-surface more or less predominantly straight-haired, with leaves lightly pubescent and scarcely lobate, with involucral lobes foliaceous, or with whitish flowers.... (vars. of *M. arboreus*)

E. Leaves slender (decidedly longer than broad), with shallow jagged lobes, rounded or but slightly cordate at base; involucral lobes never foliaceous.

F. Flowers white; central Mexico............*3d. M. arboreus* var. *Hintoni*
FF. Flowers red; Mexico to South America, West Indies.
G. Flowers more than 4.2 cm. long, robust......................
..............................*3h. M. arboreus* var. *penduliflorus*
GG. Flowers 2.3–4.2 cm. long...........*3f. M. arboreus* var. *mexicanus*
GGG. Flowers less than 2.3 cm. long; chiefly West Indian............
..................................*3b. M. arboreus* var. *cubensis*
EE. Leaves broad (as broad or nearly as broad as long), usually conspicuously cordate at base.
H. Involucral lobes expanded and more or less foliaceous, broadly lanceolate; South America.............*3j. M. arboreus var. Williamsii*
HH. Involucral lobes linear, linear-oblanceolate, or linear-ovate, usually broadest at or above the middle.
I. Leaves uniformly and symmetrically obtuse-lobate; pubescence of the upper leaf-surface almost always predominantly simple; branchlets and petioles usually uniformly short-pubescent; Gulf States of the United States and Mexico........*3c. M. arboreus* var. *Drummondii*
II. Lobed and unlobed leaves on same plant or lobes irregular and varying in size; pubescence of upper leaf-surface usually predominantly stellate; branchlets and petioles usually glabrous, scabrous, long-haired, or with longitudinal ridges of hairs; Central Mexico to South America; West Indies.
J. Calyx slightly (less than twice) longer than broad, subturbinate, or short-cylindric with more or less flaring or spreading lobes, tube scarcely longer than fruit.
K. Flowers more than 4.2 cm. long, robust..................
...........................*3h. M. arboreus* var. *penduliflorus*
KK. Flowers 2.3–4.2 cm. long........*3f. M. arboreus* var. *mexicanus*
KKK. Flowers less than 2.3 cm. long; chiefly West Indies......
.............................*3b. M. arboreus* var. *cubensis*
JJ. Calyx about twice as long as broad, long-cylindric, with tube manifestly longer than fruit, contracted above fruit and enclosing it; leaves almost always unlobed; South America......
...............................*3e. M. arboreus* var. *longifolius*
CC. Leaves unlobed, essentially ovate-lanceolate.
L. Branchlets, petioles or lower leaf-surface very heavily haired, with a dense felt-like or velvet-like pubescence, or with long semi-rigid yellowish hairs..*3. M. arboreus*
LL. Branchlets, petioles and lower leaf-surface pubescent or glabrous, but pubescence never continuously so dense as to be velvet-like............
....(vars. of *M. arboreus)*
M. Involucral lobes broadly lanceolate (at least 3 mm. broad at the base), more or less foliaceous; South America....................
.....................................*3j. M. arboreus* var. *Williamsii*
MM. Involucral lobes linear or linear-lanceolate to obovate or spatulate (always less than 3 mm. broad at base), never foliaceous.
N. Calyx about twice as long as broad, long-cylindric, with tube manifestly longer than fruit, contracted above fruit and enclosing it; South America.......................*3e. M. arboreus* var. *longifolius*
NN. Calyx slightly (less than twice) longer than broad, subturbinate, or short-cylindric with more or less flaring or spreading lobes, tube scarcely longer than fruit.

O. Leaves almost perfectly elliptic, broadest at the middle, with 3 large palmate veins from which lateral veins emerge almost at right angles; Costa Rica..............*3g. M. arboreus* var. *palmanus*

OO. Leaves from linear-lanceolate to ovate-cordate, broadest below the middle, with 3–7 large veins and variable reticulation patterns.

P. Flowers white; central Mexico........*3d. M. arboreus* var. *Hintoni*

PP. Flowers red.

Q. Leaves narrow, oblong-lanceolate, 2.5–3.5 times as long as broad; pubescence of upper leaf-surface predominantly stellate; petioles short (0.5–3.0 cm.); flowers small (2.0–2.5 cm. long); British Honduras......*3a. M. arboreus* var. *brihondus*

QQ. Leaves broader than in var. *brihondus*, lanceolate to ovate-cordate; pubescence of upper leaf-surface often predominantly straight-haired; petioles and flowers variable in length, usually longer and larger than in var. *brihondus*

R. Involucral lobes spatulate, broadest above the middle; flowers small (2.0–3.2 cm. long); upper leaf-surface predominantly straight-haired; Vera Cruz and Nuevo Leon, Mexico.........................*3i. M. arboreus* var. *sepium*

RR. Involucral lobes usually linear or linear-lanceolate (if spatulate, upper leaf-surface without straight hairs); flowers large or small; pubescence of upper leaf-surface generally predominantly stellate.

S. Flowers more than 4.2 cm. long; robust.............. ....*3h. M. arboreus* var. *penduliflorus*

SS. Flowers 2.3–4.2 cm. long....*3f. M. arboreus* var. *mexicanus*

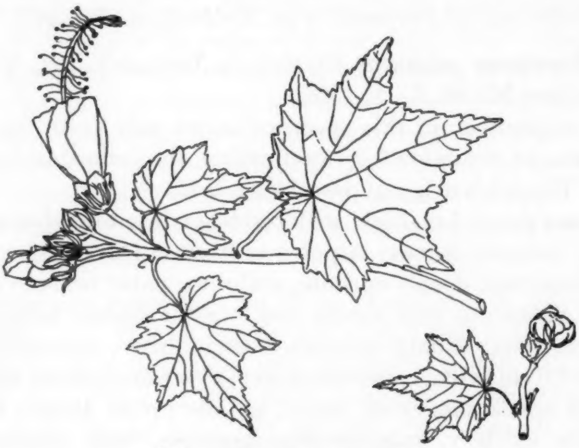
SSS. Flowers less than 2.3 cm. long; chiefly West Indies...... ....*3b. M. arboreus* var. *cubensis*

1. **Malvaviscus candidus** DC. Prodr. **1**: 445. 1824; Moc. & Sessé ex A. DC. Calcq. des Dess. *pl. 90.* 1874; Standl. in Contr. U. S. Nat. Herb. **23**: 774. 1923.

Malvaviscus Pringlei E. G. Baker ex Robins. & Greenm. in Am. Jour. Sci. III, **50**: 175. 1895; Standl. loc. cit. 774. 1923, in syn.

Shrubs, with upper branches, petioles and pedicels densely stellate-pubescent, the hairs often in clusters. Leaves large, up to 18 cm. broad, densely or thinly stellate-pubescent on lower surface, upper surface predominantly straight-haired; lobes 5, triangular-acute, dentate, often irregularly so, terminal lobe largest, basal pair smallest; veins (5 large palmate veins and many small reticulate ones) conspicuous, especially elevated on lower surface, usually heavily haired; petioles 2–20 cm. long; stipules linear, 5–7 cm. long, caducous. Inflorescence terminal or subterminal, or occasionally flowers solitary towards tip of the leafy branch; flowers large and showy, about 8 cm. long; involucral lobes generally 12, linear or narrowly linear-lanceolate, somewhat shorter than the calyx, pubescent; calyx about 2 cm. long, often inconspicuously ridged longitudinally, lightly

pubescent or subglabrous on the outside, glabrous inside except toward the pannose margins of the ovate-lanceolate calyx-lobes and the lower portion of the calyx-tube which is encrusted with fleshy hairs; corolla white, petals subretuse, lightly pubescent on the outside below the middle, with curled, simple, coarse hairs; receptacle convex; ovary depressed-globose; style usually 12–14 cm. long, curved upward, the style-branches 7–10 mm. long, pubescent; staminal column arcuate, usually 11–13 cm. long, 5-dentate, staminiferous in its upper half; filaments linear, about 1 cm. long, subglabrous; anthers about 2 mm. long. Fruit 1.5 cm. in diameter,



M. candidus, × approx. ⅓.

consisting of 5 brown-black, 1-seeded, ridged carpels which separate at maturity; seed reniform, about 6 mm. long.

Distribution: north-central Mexico (see Map 2).

Specimens examined:

MEXICO: COAHUILA—Saltillo, *Palmer 686* (A, F, G, M, NY, US). GUANAJUATO—Guanajuato, *Duges 281* (G). JALISCO—Colotlan, *Rose 2670* (G, US). QUERETARO—without exact locality, *Agniel 10621* (US). MEXICO—Mexico, *Rose & Hay 6354* (US); Molino, *MacDaniels 526* (F). MICHOACAN—Lake Cuitzeo, *Pringle 4132* (A, F, G, M, NY, US).

This species is very distinct from *Malvaviscus arboreus* and its varieties, being easily recognized by the large white flowers with up-curving staminal column and long filaments. Also the nearly star-shaped leaf is seldom found in *M. arboreus*.

It cannot be said that plate 90 of deCandolle's 'Calcques des Dessins de Mociño & Sessé's Flore des Mexique' is undeniably *Malva-*

viscus. The illustration, in some respects, rather indicates another genus, possibly *Hibiscus.* For example, only 5 style-branches are shown, the involucre or subcalyx appears almost foliaceous, the fruit somewhat capsule-like, and the seed is not reniform. Yet the whole set of Mociño & Sessé illustrations seems to a degree inaccurate as regards details, and it appears better to regard the abovementioned characters as craftmanship inaccuracies rather than to consider the species name *candidus* as a "nomen dubium." This seems desirable, as in general appearance the Mociño & Sessé illustration could scarcely fit any other plant, having convolute corollas, auriculate petals, curved staminal column, etc., characters manifest in Baker's later-proposed type, *Malvaviscus Pringlei.*

2. **Malvaviscus palmatus** Ulbrich, in Verhandl. Bot. Ver. Prov. Brandenburg **50**: 89, *fig. 1.* 1908.

Since a specimen of this species (known only from the type) is not at present available for examination, the following free translation of Ulbrich's original description is given:

Glabrous shrub 3 m. high, with terete, striate branches and long-petiolate palmate leaves; stipules caducous; leaves 7-nerved, palmately dissected, deeply cordate, glabrous, paler beneath and very sparsely pubescent with simple and 3-rayed stellate hairs, 7-lobed, lobes lanceolate, usually caudate-subacuminate, repand, 5–10 cm. long, 1.5–2.0 cm. wide, cinereous-green, also puncticulate and pubescent with small adpressed hairs; petiole up to 15 cm. long; inflorescence axillary, subumbellate-racemose, with several short-petiolate palmately dissected leaves; flowers very large, with pedicels 1–2 cm. long; involucre 15–20 mm. long, 9-lobed, lobes linear-lanceolate, 12–15 mm. long, 1.5 mm. wide, acute, fringed with subrigid yellow hairs, after anthesis somewhat accrescent; calyx cylindric-campanulate, 18–20 mm. long, 5-lobed, nerves and margins fringed with small, crisp, rigid hairs; calyx-lobes deltoid-subacuminate, 5 mm. long; petals dark red, obovate-cuneate, obtuse, about 4 cm. long, about 22 mm. broad at the broadest part, unguiculate, ciliate with minute, crisp hairs, above sparingly and below densely pubescent with coarse, 3-rayed and fine simple hairs; staminal tube 6 cm. long or longer, tenuous, barely 1 mm. in diameter, apically with 5 acute lobes each 1 mm. long, 2 mm. from the top bearing stamens for 8 mm. of its length; filaments delicate, 1.5 mm. long; style exceeding the staminal tube only about 2 mm., 9-parted into subliguliform style branches each about 3 mm. long; stigmas sub-

capitellate; stigma, style and staminal tube dark violet; fruit subglobose, black, baccate, glabrous, about 10 mm. in diameter; carpels prominently nerved on the outside, subangulate, 1-seeded; seed subreniform, 6 mm. long, 2–3 mm. wide, glabrous, fuscous.

Distribution: Brazil (see Map 3).

Specimens examined: none available.

If the description and figure presented by Ulbrich are entirely accurate, *Malvaviscus palmatus* is indeed unlike any other *Malvaviscus* known. So distinctive are the deeply lobed palmate leaves that this species could not be confused with any other in the genus. From description only, it is difficult to say with surety that this species may not belong in the genus *Pavonia;* yet Ulbrich's description of the fruit and his excellent illustration of the type specimen indicate that this plant probably is a *Malvaviscus.* On the other hand, the original description does not state that the petals are auriculate, from which the inference is that the plant may be *Pavonia.* Certainty of identification will have to await examination of the type or some authentic specimen; meanwhile the species had best remain as *Malvaviscus palmatus.*

3. **Malvaviscus arboreus** Cav. Tert. Diss. Bot. 131, *pl. 48, fig. 1.* 1787; HBK. Nov. Gen. & Sp. **5**: 287. 1821 [1822]; DC. Prodr. **1**: 445. 1824; G. Don, Gen. Hist. Dichlamyd. Pl. **1**: 475. 1831; Spach, Hist. Nat. Veg. Phan. **3**: 369. 1834; Schlecht. in Linnaea **11**: 359. 1837; E. G. Baker in Jour. Bot. **37**: 344. 1899; Standl. in Contr. U. S. Nat. Herb. **23**: 775. 1923.

Hibiscus Malvaviscus L. Sp. Pl. **2**: 694. 1753.

Achania Malvaviscus (L.) Sw. Prodr. Veg. Ind. Occ. 102. 1788; Ait. Hort. Kew. **2**: 459. 1789 (possibly var. *mexicanus).*

Achania pilosa Sw. loc. cit. 102. 1788; ?Ait. loc. cit. 459. 1789; Sw. Fl. Ind. Occ. **2**: 1224. 1800; Lodd. Bot. Cab. *pl. 829.* 1817? (possibly var. *mexicanus* or *cubensis,* but better not to be used as name-bringing synonym for either variety because of uncertainty of synonymy).

Achania mollis Ait., loc. cit. 459. 1789.

Achania coccinea Salisb. Prodr. 385. 1796.

Malvaviscus cordifolius Moench, Meth. Suppl. 208. 1802.

Malvaviscus acapulcensis HBK. Nov. Gen. & Sp. **5**: 286. 1821 [1822].

Malvaviscus concinnus HBK. loc. cit. 286. 1822.

Malvaviscus Balbisii DC. Prodr. **1**: 445. 1824.

Malvaviscus cordatus Balb. ex DC. loc. cit. 445. 1824, nomen nudum, in synon.

Malvaviscus mollis DC. loc. cit. 445. 1824; Mart. Fl. Bras. **12**³: 538. *pl. 106.* 1892.

Malvaviscus pilosus DC. loc. cit. 445. 1824; Macfad. Fl. Jam. **1**: 64. 1837.

Achania concinna (Kth.) Spreng. in L. Syst. Veg. ed. 16, **3**: 100. 1826.

Malvaviscus acerifolius Presl, Reliq. Haenk. **2**: 135. 1835; Standl. in Contr. U. S. Nat. Herb. **23**: 775. 1923.

Hibiscus racemosus Willd. ex Steud. Nom. Bot. ed. 2, **1**: 760. 1841.

Malvaviscus spathulatus Garcke in Otto & Dietr. Allg. Gartenz. **21**: 321. 1853.

Malvaviscus velutinus Triana & Planch. in Ann. Sci. Nat. Bot. IV, **17**: 168. 1862; Mart. loc. cit. 1892, in synon.

Malvaviscus speciosus Lind. & Planch. ex Mart. loc. cit. 1892.

Malvaviscus arboreus var. *pilosus* Hitchc. in Ann. Rept. Mo. Bot. Gard. **4**: 64. 1893.

Malvaviscus arboreus var. *parviflorus* E. G. Baker in Jour. Bot. **37**: 345. 1899.

Malvaviscus Malvaviscus (L.) Millsp. in Pub. Field Mus. Bot. **2**: 73. 1900.

Malvaviscus Cutteri Standl. in Pub. Field Mus. Bot. **4**: 315. 1929.

Shrub or vine-like plants with branchlets, petioles and pedicels densely velvety-pubescent (rarely almost glabrous), pubescence shorter and rougher in plants of certain subxerophytic regions. Leaves petiolate, variously lobed to entire, densely stellate-pubescent on lower surface, lightly to densely pubescent on upper surface, coarsely serrate to sinuate on the margins. Flowers 2.8–5.5 cm. long. Involucre usually densely pubescent, with 6 or more linear, linear-lanceolate or spatulate lobes approaching or exceeding the calyx in length. Calyx variously pubescent, generally with 5 subdeltoid lobes. Corolla red, of 5 generally deeply retuse petals. Mature staminal column usually exserted ⅓–¼ of its length.

Distribution: Mexico to Peru and Brazil; occasional in West Indies (see Map 1).

Specimens examined:

MEXICO: CAMPECHE—Carasayal, *Goldman 461* (US); Champoton, *Steere 1924* (F); Tuxpena, *Lundell 970* (A, F, M, NY, US). CHIAPAS—Comitan, *Goldman 904* (US);

Escuintla, *Matuda 95* (US); Huehuetan, *Nelson 3835* (US); Ocuilapa, *Nelson 3005* (G, US); San Vicente, *Goldman 864* (US); Teopisca, *Nelson 3454* (G, US), *Goldman 940, 983* (US); without definite locality, *Ghiesbreght 642* (G, M). DURANGO—Tamazula, *Gentry 5258* (G, NY). HIDALGO—Dublan, *Rose & Hay 5302* (US); Jacala, *Chase 7073* (F, G, M, NY), *Edwards 818* (F), *Lyonnet 1298, 1323* (US); Tula valley, *Pringle 8232* (A, F, G, M, NY, US), *9455* (G, US), *9688* (F G, M, NY, US). JALISCO—Barranca de Oblatos, *Barnes & Land 203* (F, US); Etzatlan, *Rose & Painter 7541* (G, US); Guada-

M. arboreus, × approx. ⅓.

lajara, *Pringle 8498* (F, G, M, NY, US); Lake Chapala, *Pringle 5973* (US); La Palma, *R.E.J. 111* (US). MEXICO—Churubusco, Federal District, *Orcutt 4294* (F); Mexico City, *Rose & Hough 4237* (US); Temascaltepec, *Hinton 3861* (A, NY, US), *5145* (M), *7184* (A, F, NY); Tlalpam, *Rose, Painter & Rose 8497* (G, NY, US). MICHOACAN—Morelia, *Arsène 34* (F), *2729* (US), *5494* (A, G, M, NY, US), *Dugès 173* (G). MORELOS—Cuernavaca, *Pringle 9275* (US), *Rose & Hough 4363* (US). NAYARIT—Acaponeta, *Rose, Standley & Russell 14210* (G, NY, US); between Tepic and Mazatlan, *Gregg 1110* (M); San Blas, *Maltby 1* (US). OAXACA—Cerro San Felipe, *Conzatti & Camino 2447* (US);

Oaxaca, *Conzatti & Gonzalez 27* (M, US); Sierra de San Felipe, *Pringle 5609* (G, US). SAN LUIS POTOSI—Tamazunchale, *Kenoyer A373* (F). SINALOA—Coacoyolitos, *Ortega 6444* (G, US); Escuinapa, *Ortega 5183* (US), *6114* (A, G); Mazatlan, *Rose, Standley & Russell 14096* (G, NY, US); Villa Union, *Lamb 399* (G, M, NY, US), *Rose, Standley & Russell 13939* (NY, US). TAMAULIPAS—Chamal Hda., *Wooton* (US); Tampico, *Kenoyer 772a* (F). VERA CRUZ—Fortuno, *Williams 8977* (F); Juana Ramirez, *Palmer 470* (US); Rinconada, *Schery 204, 206* (M). YUCATAN—Chichankanab, *Gaumer & sons 23686* (F, G, NY, US); Uxmal, *Schott 643* (F), *Steere 2020* (F).

GUATEMALA: CHIMALTENANGO—Chimaltenango, *Standley 79935* (F, US); Patzum, *Standley 61483* (A, F); Tecpam, *Skutch 541* (A, F, NY, US). CHIQUIMULA—Amatillo, *Steyermark 30505* (F); Chiquimula, *Steyermark 30615* (F); Ipala, *Steyermark 30360* (F). HUEHUETENANGO—Huehuetenango, *Holway 766* (US), *Standley 81929* (F, M); Quen Santo, *C. & E. Seler 2681* (A, G, US); San Miguel Acatan, *Skutch 1021* (A, F, NY). JALAPA—Jalapa, *Steyermark 32851* (F). JUTIAPA—Asuncion Mita, *Steyermark 31959* (F); Jutiapa, *Standley 75248* (F, M). PETEN—Tikal, *Cook & Martin 63* (G, US), *197* (US). QUEZALTENANGO—Zunil, *Steyermark 34989* (F). QUICHE—San Miguel Uspantan, *Heyde & Lux 2920* (G, M, NY, US); WITHOUT DEFINITE LOCALITY—*Heyde 193a* (US). SACATEPEQUEZ—Antigua, *Standley 61127* (F); Duenas, *Standley 63263* (F); Santa Lucia, *Popenoe 690* (US); Santiago, *Gomez 822* (US); Volcan Acatenango, *Kellerman 4819* (US). SAN MARCOS—Chamac, *Standley 66190* (F); Tajumulco, *Steyermark 36553* (F). SANTA ROSA—Malpais, *Heyde & Lux 6071* (G, US). SOLOLA—Primavera, *Shannon 419* (US). ZACAPA—Zacapa, *Pittier 1749* (NY, US). DEPT. IN DOUBT—near Jacaltenanjo, *Nelson 3563* (US).

HONDURAS: ATLANTIDA—Tela, *Standley 52756, 54127* (A, F, US). COMAYAGUA—El Achote, *Yuncker, Dawson & Youse 5879* (F, G, M), *5880* (F), *6239* (F, G, M, NY). SANTA BARBARA—San Pedro Sula, *Thieme 5168* (US).

SALVADOR: SAN MIGUEL—Laguna de Olomega, *Standley 21021* (G, US). SAN SALVADOR—San Salvador, *Calderon 121* (F, G, M, NY, US), *Standley 22690* (G, NY, US); Volcan de San Salvador, *Standley 22975* (G, NY, US). SAN VICENTE—San Vicente, *Standley 21402* (G, US). WITHOUT DEFINITE LOCALITY—*Renson 8* (US).

NICARAGUA: MANAGUA—Managua, *Artemio 72* (US), *Chaves 75* (US), *Garnier 291* (US), *Greenman 5665, 5712* (M), *Maxon, Harvey & Valentine 7275, 7353* (US), *7450* (NY, US); Momotombo, *Smith 118* (G, M, US). RIVAS—San Juan del Sur. *West 3552* (G, M).

COSTA RICA: ALAJUELA—Carrillos de Poas, *Brenes 19308* (F); San Ramon, *Brenes 17050, 21480, 21917* (F), *Tonduz 17654* (US). CARTAGO—Cartago, *Biolley 8977* (US), *Cooper 54* (F), *Standley 33368* (US); Copey forest, *Tonduz 11693* (F, US). SAN JOSE—Cerro de Escaso, *Solis 266* (F); San Jose, *Valerio 220* (F); Santa Maria de Dota, *Standley 42268* (US), *Tonduz 11631* (US). PROV. IN DOUBT—between Santiago and Picacho Mondongo, *Brenes 16967* (F); exact locality unknown, *Worthen* (M), *Valerio 67* (US).

WEST INDIES: BARBADOS—Lodge Hill, St. Michael, *Botanic Station 508* (NY, US). CUBA—Havana Botanical Garden, *Britton & Wilson 511* (NY), *Curtiss 726* (A, F, G, M, NY, US); Havana, *Leon 695* (NY); Olimpo Finca, *Hioram 3976* (NY); Oriente, *Ekman 10069* (NY); Santiago de las Vegas, *Baker 7* (A, G, M, NY, US). JAMAICA—Mount Pleasant, *Harris 11143* (F, NY, US); St. Andrew, *Harris 11835* (F, G, M, NY, US). VIRGIN ISLANDS—St. Thomas, *Northrop 3* (NY).

COLOMBIA: CUNDINAMARCA—Bogotá, *Triana 388, 3132* (US); El Colegio, *Aristé-Joseph 1060* (A, F, US); El Paso, *Arbelaez & Cuatrecasas 6565* (US); Girardot, *Rusby & Pennell 143* (NY), *170* (NY, US); Ubague, *Aristé-Joseph* (US). SANTANDER—Las Vegas, *Killip & Smith 16087* (G, US). SANTANDER DEL NORTE—Tapata, *Killip & Smith 20179* (G, US). TOLIMA—Honda, *Aristé-Joseph A975, s.n.* (US), *Holton 748* (G, NY).

VENEZUELA: DISTRITO FEDERAL—Caracas, *Pittier 7121* (G, NY, US), *11116* (A, G,

NY, US). MÉRIDA—Tabay, *Gehriger 565* (F, US). MIRANDA—San Diego de los Altos, *Pittier 13014* (A, F, NY, US).

ECUADOR: CHIMBORAZO—Huigra, *Rose 22595* (US).

PERU: JUNIN—Chanchamayo Valley, *Schunke 21, 1492* (F); Juaja, *Univ. of Lima 13* (L); San Ramon, *Killip & Smith 24714* (F, NY, US), *Schunke A116* (F, US). LIMA—*Univ. of Lima 75* (L). LORETO—Balsapuerto, *Klug 3015* (A, F, G, M, US).

BRAZIL: AMAZONAS—mouth of Rio Embira, *Krukoff 5150* (A, F, NY, US).

This species shows an "influence" possibly derived from a cross with *M. candidus* in west-central Mexico some time ago and other later crosses with many varieties from Texas to South America. Thus it is a catch-all species for specimens approaching all the

M. arboreus var. *brihondus* × approx. ⅓.

M. arboreus var. *cubensis* × approx. ⅓.

varieties but differing in some way due to what may be termed the "candidus influence." This "candidus influence" may be manifest in either or both of two ways: (1) dense velvety pubescence of petioles, pedicels, upper branches, and lower leaf surface, or (2) distinctive lobation of the leaf towards the *M. candidus* type.

3a. Malvaviscus arboreus var. **brihondus**[23] Schery, n. var.

Shrub, upper branches pubescent, often scantily so, with appressed-stellate or straight hairs. Leaves oblong-lanceolate, 2.5–3.5 times as long as broad, unlobed, bluntly dentate to sinuate, sparsely pubescent on lower surface with large stellate hairs, upper surface with small appressed stellate hairs predominating over

[23] Frutex foliis oblongo-lanceolatis stellato-pubescentibus 2.5–3.5 plo longioribus quam latioribus; petiolis brevibus, 0.5–3.0 cm. longis; floribus parvis, 2.0–2.5 cm. longis.

straight hairs; petioles short, 0.5–3.0 cm., usually finely pubescent. Flowers very small, 2.0–2.5 cm. long. Involucral lobes usually wider toward the apex than toward the base. Mature staminal column exserted about half its length.

Distribution: British Honduras (see Map 2).

Specimens examined:

BRITISH HONDURAS: All Pines, *Schipp 708* (A, F, G, M, NY); Belize, *Lundell 4246* (F); Belize River, *Record* (G, US); El Cayo, *Gentle 2373* (A); Honey Camp, *Lundell 13, 52* (F), *480* (F, M TYPE, US), *Meyer 163* (F); Prospecto, *Gentle 870* (A, F, M, NY); Tower Hill Estate, *Karling 43* (F, US).

Distinguishing features of this variety are the small flower and the long, relatively narrow leaf which is generally short-petiolate and rounded at the base.

3b. Malvaviscus arboreus var. **cubensis** Schlecht. in Linnaea **11**: 360. 1837.

Malvaviscus Jordan-Mottii Millsp. in Field Col. Mus. Bot. **2**: 73. 1900.

Malvaviscus Cokeri Britton ex Coker in Shattuck, Bahama Isl. 259. 1905.

Woody shrub-like plants with upper branches, pedicels and petioles subglabrous or pubescent, usually with long (1.0–1.5 mm.) hairs. Leaves lanceolate to ovate-lanceolate, cordate or subcordate at the base, bluntly dentate to sinuate-margined, hairs preponderantly stellate on both upper and lower leaf-surfaces. Flowers very small, less than 2.3 cm. long. Involucral lobes linear or sublinear, densely or lightly pubescent. Mature staminal column exserted ½ to ⅓ its length.

Distribution: West Indies and occasional near the Yucatan Peninsula (see Map 2).

Specimens examined:

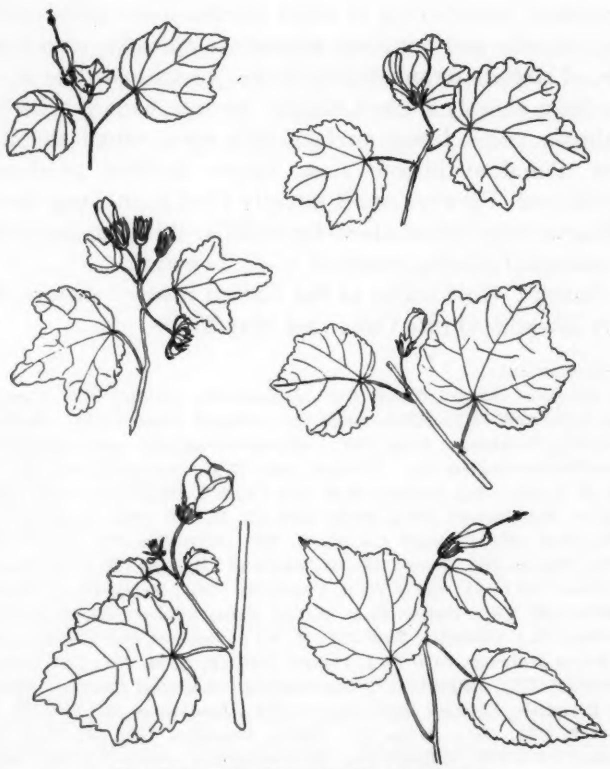
MEXICO: OAXACA—Tuxtepec, *Nelson 363* (US).

GUATEMALA: SACATEPEQUEZ—Acatenango, *Kellerman 4990* (US).

WEST INDIES: BAHAMA ISLANDS—Abaco: *Brace 1527* (A, F, US). Great Bahama: *Brace 3541* (F), *Britton & Millspaugh 2442* (F, G, US). Cayman Brac: The Creek, *Millspaugh 1166* (F). CUBA—Camarioca, *Britton & Wilson 14032* (NY, US); Cerro de Esperon, *Killip 13511* (US); Corrientes Bay, *Britton & Cowell 9902* (G, US); Guanajay, *Baker & Van Hermann 4253* (NY), *Palmer & Riley 697* (NY); San Juan Valley, *Roig 3160* (NY); without exact locality, *Wright 2064* (G, M). GRAND CAYMAN—Spot Bay, *Millspaugh 1313* (F); without exact locality, *Hitchcock* (F, M), *Rothrock 180, 237* (F). ISLE OF PINES—Boqueron, *Britton, Wilson & Selby 14498* (US). JAMAICA—Porus, *Lloyd 1108* (F, M); without exact locality, *Hart* (F).

This variety is close to var. *brihondus* from which it can be distinguished most easily by the broader, generally cordate leaf. It is distinguished from var. *mexicanus* and other varieties by the very small flowers.

3c. Malvaviscus arboreus var. **Drummondii** (Torr. & Gray) Schery, n. comb.



M. arboreus var. *Drummondii*, × approx. ⅓.

Malvaviscus Drummondii Torr. & Gray, Fl. N. Am. **1**: 230. 1838; Eaton & Wright, N. Am. Bot. 314. 1840; Engelm. & Gray in Boston Jour. Nat. Hist. (Pl. Lindh.) **5**: 6. 1845; Gray, Gen. Pl. U. S. **2**: 78, *pl. 131*. 1849; Gray in Smithson. Contr. to Knowledge (Pl. Wright.) **3**: 22. 1852; Torrey, Bot. Mex. Bound. Surv. 40 1856; Wood, Class-book Bot. 269. 1865; Coulter in Contr. U. S. Nat. Herb. (Bot. W. Texas) **2**: 43. 1891; Standl. in Contr. U. S. Nat. Herb. **23**: 774.

1923; Small in Addisonia **15**: 19, *pl. 490.* 1930; Man. Southeast. Fl. 854. 1933.

Pavonia Drummondii Torr. & Gray, Fl. N. Am. **1**: 682. 1840, fide S. Wats. loc. cit. 139. 1878; Walp. Rep. **1**: 298. 1842; Dietr. Syn. Pl. **4**: 824. 1847; Gray, Gen. Pl. U. S. **2**: 76. 1849.

Hibiscus Drummondii Young, Fl. Texas, 186. 1873, fide S. Wats. Bibl. Ind. 139. 1878.

Procumbent, clambering or erect shrub; stems glabrous toward the base, densely and minutely tomentose apically, with tomentum uniform, of stellate or substellate hairs. Leaves cordate at base, as broad as long, shortly 3-lobed, bluntly dentate, usually with 5 prominent palmate veins, lower surface with many small stellate hairs and less abundant larger ones, upper surface predominantly straight-haired. Flowers small, usually 2.5–3.0 cm. long. Involucral lobes oblanceolate, widest above the middle, obtuse or acute apically. Mature staminal column exserted ½–¼ its length.

Distribution: Gulf states of the United States; eastern Mexico; evidently introduced into Cuba (see Map 2).

Specimens examined:

UNITED STATES: FLORIDA—Duval Co.: Jacksonville, *Curtiss* (G); Escambia Co.: Pensacola, *McCormick* (G); Hillsborough Co.: without exact locality, *Fredholm 6413* (G); Leon Co.: Tallahassee, *Berg* (NY). LOUISIANA—without exact locality, *Chapman* (NY). MISSISSIPPI—Adams Co.: Natchez, *Gale* (NY). TEXAS—Bexar Co.: Bracken, *Groth 209* (F, G, US); San Antonio, *Bush 1211* (M, NY, US), *Clemens 610* (M), *Dewey* (US), *Eggert* (M), *Havard* (US), *Heller 1833* (G, M, NY, US), *Jermy 191* (M), *271* (US), (M), *Metz* (NY), *Palmer 115* (G, M, US), *Reverchon 1197* (F, M, US), (F), *255518* (M), *Thurber* (G), *Ward* (US), *Wilkinson 47* (M), *102* (M, NY); Brazoria Co.: Brazoria, *Fisher 125* (US); Sandy Point, *Fisher 191* (US); Brazos Co.: College Station, *Palmer 10756* (M, US); Burnet Co.: Marble Falls, *Biltmore Herb. 11079a, 11079b* (US); Caldwell Co.: Columbia, *Bush 312* (M, NY); Cameron Co.: Brownsville, *Barber 23* (US), *Ferris & Duncan 3150* (M), *Pringle 1959* (F, G, M, NY, US), *Runyon* (M), *Townsend 49* (F, US), *Sargent* (A); Chambers Co.: Anahuac, *Hanson 2* (US); Comal Co.: New Braunfels, *Biltmore Herb. 11079e* (US), *Lindheimer 25* (F, G, M, US), *685* (F, G, M, NY, US), (M); Dallas Co.: Dallas, *Reverchon 1195* (F, US); Falls Co.: Gurley, *Howell 247* (US); Gillespie Co.: Fredericksburg, *Jermy 707* (M); Goliad Co.: Goliad, *Williams 70* (F, M); Harris Co.: Hockley, *Thurrow* (F); Houston, *Buckley* (M), *Hall 53* (F, G), *Mohr* (US), *Palmer 8584* (M, NY, US), *Ward* (US); Sheldon, *Reverchon 3827* (M); Hays Co.: San Marcos, *Trelease* (M), *Tharp* (NY); Jackson Co: Horseshoe Lake, without collector's name (M); Navidad River, *Drushel 2844* (M); Kendall Co.: Spanish Pass, *Clemens 609* (M, NY). Madison Co.: Trinity River, *Dixon 441* (F, G, NY); Montgomery Co.: Willis, *Warner* (M); Travis Co.: Austin, *Biltmore Herb. 11079c, 11079d* (US), *Letterman 66* (M, NY), *102* (M, US), *Bogusch 115* (A); Victoria Co.: Victoria, *Clark 3977* (M); Wharton Co.: Pierce, *Tracy 7476* (F, G, M, NY, US); Wharton, *Palmer 6609* (M, US); Williamson Co.: Round Rock, *Bodin 129* (US).

MEXICO: SAN LUIS POTOSI—Canoas, *Rose & Hough 4883* (US); Tancanhuitz, *Nelson*

4392 (US). TAMAULIPAS—El Milagro, *Bartlett 11069* (F, US); San Jose, *LeSueur 283* (F); Tampico, *Palmer 94* (G, M, NY, US), *387* (US), *525* (G, US).

WEST INDIES: CUBA—without exact locality, *Wright 2065* (M), *2068* (G, M, NY, US).

This is one of the most distinct varieties of *M. arboreus*. It is best distinguished by a combination of characters including the broad, cordate, obtusely lobed leaf; predominance of straight hairs on the upper leaf surface; and involucral lobes which are broadest above the middle.

3d. Malvaviscus arboreus var. **Hintoni** (Bullock) Schery, n. comb.
Malvaviscus Hintoni Bullock in Kew Bull. 291. 1937.

Shrub with upper branches, pedicels and petioles pubescent with long hairs (usually 1.0–1.5 mm. long). Leaves lanceolate, 2–3 times

M. arboreus var. *Hintoni*
× approx. ⅓.

M. arboreus var. *longifolius*
× approx. ⅓.

as long as broad, sometimes obscurely 3-lobed, rounded at base, bluntly serrate, lightly pubescent, lower surface with large stellate hairs, upper surface with smaller stellate and straight hairs. Flowers 3.5–5.0 cm. long, white or whitish. Involucral lobes linear or linear-spatulate. Mature staminal column exserted ⅓–¼ its length.

Distribution: east-central states of Mexico (see Map 2).

Specimens examined:

MEXICO: MEXICO—Temascaltepec, *Hinton 690* (F), *3928* (A, NY), *4289* (A, F, NY), *5057* (A, M, NY), *5371* (A, NY), *7912* (US). VERA CRUZ—Chontla, *Cardenas 375* (A, F).

This variety is very close to marginal types of *M. arboreus* and *M. arboreus* var. *mexicanus* but can be distinguished by the white

flowers (all other varieties have red flowers) and comparatively narrow lanceolate leaves.

3e. Malvaviscus arboreus var. **longifolius** (Garcke) Schery, n. comb.

Malvaviscus longifolius Garcke in Otto & Dietr. Allg. Gartenz. **22**: 321. 1854.

Malvaviscus cuspidatus Turcz. in Bull. Soc. Nat. Mosc. **31**: 190. 1858.

Malvaviscus leucocarpus Planch. & Linden ex Triana & Planch. in Ann. Sci. Nat. Bot., IV, **17**: 169. 1862; Mart. Fl. Bras. **12**^{3}: 536. 1892.

Malvaviscus Funkeanus Linden & Planch. Trois Voy. Linden in Pl. Columb. **1**: 41. 1863.

Malvaviscus elegans Linden & Planch. ex Mart. loc. cit. 537. 1892.

Malvaviscus maynensis Huber in Bol. Mus. Goeldi **4**: 583. 1906.

Malvaviscus integrifolius Ulbrich in Verhandl. Bot. Ver. Brandenburg **50**: 88. *fig. 2.* 1908.

Malvaviscus Ulei Ulbrich in Notizblatt **6**: 328. 1915.

Shrub-like plants with upper branches, pedicels and petioles usually with long (1.0–1.5 mm.) hairs, or glabrous. Mature leaves generally large (seldom less than 8 cm. long), ovate-lanceolate to triangular, usually cordate at the base, bluntly dentate or sinuate margined, entire or slightly lobed, upper surface variously pubescent, lower surface stellate-pubescent. Flowers large, usually longer than 4 cm. Involucral lobes linear or linear-lanceolate, usually narrow to acuminate-attenuate. Calyx long-cylindric, usually twice as long as broad or longer, often yellow-setose, contracted above and enclosing the fruit. Mature staminal column exserted ⅓–⅙ its length.

Distribution: northern South America (see Map 3).

Specimens examined:

COLOMBIA: ANTIOQUIA—Angostura?, *André K862* (F, G, NY). ATLANTICO—Barranquilla, *Elias 428* (US); Usiacuri, *Dugand 887* (F). BOLIVAR—Cartagena, *Heriberto 244* (US). WITHOUT EXACT LOCALITY—*Mutis 2262* (US).

VENEZUELA: DISTRITO FEDERAL—Caracas, *Allart 76* (NY, US); Cerro Avila, *Vogl. 76* (F); Los Flores a Papelon, *Delgado 271* (F, US), *Tamayo 385* (US). LARA—Barquisimeta, *Saer 65* (US). MÉRIDA—Tovar, *Fendler 101* (G, M).

ECUADOR: ORO—Santa Rosa, *Hitchcock 21141* (NY, US).

PERU: AYACUCHO—Estrella, *Killip & Smith 23065* (F, G, NY, US). JUNIN—Puerto Bermudez, *Killip & Smith 26648* (NY, US). LORETO—Iquitos, *Williams 8068* (F); La Victoria, *Williams 2675* (F); Rio Nanay, *Williams 508* (F). SAN MARTIN—Juan Jui, *Klug 3919* (F, G, M, NY, US), *4382* (A, F, M, NY, US).

BRAZIL: AMAZONAS—Manariao, *Krukoff 4589* (A, F, M, NY, US); Seringal (Rio Acre), *Ule 9591* (US).

This variety approaches *M. arboreus* and *M. arboreus* var. *penduliflorus,* on the one hand, and *M. arboreus* var. *Williamsii,* on the other. It can best be distinguished by the very long-cylindric calyx enclosing the fruit, the linear or linear-lanceolate involucral lobes, and the relatively large, broad leaves.

3f. **Malvaviscus arboreus** var. **mexicanus** Schlecht. in Linnaea **11**: 359. 1837, as *Mexicana;* E. G. Baker in Jour. Bot. **37**: 346. 1899.

Pavonia spiralis Cav. Ic. **5**: 20, *pl. 434*. 1799.

Malvaviscus grandiflorus HBK. Nov. Gen. & Sp. **5**: 286. 1821 [1822]; Standl. in Contr. U. S. Nat. Herb. **23**: 775. 1923.

Malvaviscus ciliatus DC. Prodr. **1**: 445. 1824.

Malvaviscus pentacarpus Moc. & Sessé ex. DC. loc. cit. 1824; ex. A. DC. Calq. des Dess. *pl. 88*. 1874.

Achania ciliata Spreng. Syst. Veg. **3**: 100. 1826.

Malvaviscus brevipes Benth. Bot. Voy. Sulph. 68. 1844.

Malvaviscus pulvinatus A. Rich. Bot.—Pl. Vasc., in Sagra, Hist. Nat. Cuba, 133. 1845 (?).

Malvaviscus Sagraeanus, A. Rich. loc. cit. 131, *pl. 14*. 1845(?).

Malvaviscus Guerkeanus Hieron. in Engl. Bot. Jahrb. **21**: 320. 1895.

Malvaviscus arboreus var. *Grisebachii* E. G. Baker in Jour. Bot. **37**: 345. 1899.

Malvaviscus arboreus var. *Sagraeanus* (Rich.) Baker, loc. cit. 1899.

Malvaviscus arboreus var. *Sloanei* Baker, loc. cit. 1899.

Malvaviscus brevibracteatus Baker, loc. cit. 347. 1899.

Malvaviscus Polakowskyi Baker, loc. cit. 346. 1899.

Malvaviscus rivularis Brandg. in Zoe **5**: 211. 1905; Standl. in Contr. U. S. Nat. Herb. **23**: 774. 1923.

Malvaviscus oaxacanus Standl. loc. cit. 775. 1923.

Bushy or vine-like shrubs, with upper branches, pedicels, and petioles variously pubescent or subglabrous. Leaves lanceolate or ovate-lanceolate, rounded or cordate at base, acute or attenuate at apex, serrate to sinuate-margined, unlobed or occasionally with slight marginal projections, variously pubescent. Flower of medium size, 2.3–4.2 cm. long. Involucral lobes linear or sublinear. Calyx campanulate-cylindric, somewhat longer than broad, glabrous or pubescent. Mature staminal column exserted ½–⅓ its length.

Distribution: southernmost United States to Panama; West Indies (see Map 5).

Specimens examined:

UNITED STATES: TEXAS—Cameron Co.: Brownsville, *Hanson* (M), *Rose & Russell 24292* (US).

MEXICO: CHIAPAS—Escuintla, *Matuda 2153* (F, NY); Tumbala, *Nelson 3346* (NY, US). COLIMA—Manzanillo, *Ferris 6078, 6231* (US), *Palmer 963* (G, US); Paso del Rio, *Emrick 167* (F). GUERRERO—Acapulco, *MacDaniels 191* (F), *Palmer 536* (G, US);

M. arboreus var. *mexicanus*, × approx. ⅓.

Galeana, *Hinton 10897* (M, NY, US); Mina, *Hinton 9597* (A, F, M, US); San Luis, *Langlasse 924* (G, US). JALISCO—Tuxpan, *Mexia 1023* (A, F, M, NY, US). MEXICO—Temascaltepec, *Hinton 4563* (A, NY), *5254* (A, NY, US), *Hinton 6719* (A, F, NY, US). MICHOACAN—Morelia, *Arsène 2729* (A, G, M, US). MORELOS—Cuernavaca, *Pringle 9662* (G, US), *Rose, Painter & Rose 10220* (US). NAYARIT—San Blas, *Ferris 5436* (A, US), *Wright 1348* (F, M); Tepic, *Palmer 1955* (F, G, NY, US). OAXACA—Ejutla, *Conzatti 3948* (US); Jamiltepec, *Conzatti 4430* (US); Oaxaca City, *Rose & Hough 4587* (US); Oaxaca Valley, *Nelson 1223, 1256* (G, US), *Pringle 4923* (A, F, G, M, NY, US), *Smith 296* (G), *638* (M); Tuxtepec, *Nelson 348* (US); Ubero, *Williams 9189, 9219* (F). PUEBLA—Huanchinango, *Goldman 22* (G, US); Puebla, *Arsène 128, 389, 1957* (US). SAN LUIS POTOSI—Espinazo del Diablo, *Pennell 17975* (US); Rio Tampaon, *Chase 7481*

(F, G); Tamazunchale, *Edwards 482* (F, M). SINALOA—Balboa, *Ortega 5116* (US); Culiacan, *Brandegee* (G, US). TAMAULIPAS—Tampico, *Kenoyer 772* (F), *s.n.* (M). VERA CRUZ—Catemaco, *Nelson 405* (US); Coatzacoalcos, *Smith 1023, 1030* (G, US), *1030* (M); Fortuno, *Williams 8336* (F); Jalapa, *Plunkett 140* (F); Vera Cruz, *Greenman 49* (F, G, NY); without exact locality, *Orcutt 2899* (F). YUCATAN—Chichankanab, *Gaumer 1858* (F, G, M, US), *Gaumer & sons 23686* (M); Chichen Itza, *Seler 4913* (G, US), *Steere 1127, 1618, 1642* (F); Izamal, *Gaumer* (F, US), *Greenman 443* (F, G, NY); Kancabonot, *Gaumer & sons 23523* (F, G, M, US); Merida, *Schott 177* (F), *s.n.* (F, US); Progresso, *Schott 271* (F, US), *Millspaugh 1728* (F); Silam, *Gaumer* (F); Suitun, *Gaumer & sons 23361* (A, F, G, M, NY, US); exact locality unknown, *Gaumer 580* (A, F, G, M, NY, US), *Goldman 579* (US); *Millspaugh 42* (F, US), *60* (F). STATE IN DOUBT —Miramar, *Matuda 93* (US); without locality, *Berlandier 566* (US).

BRITISH HONDURAS: Corozal, *Gentle 208* (F, US), [*Lundell 4890*] (F, M).

GUATEMALA: ALTA VERA PAZ—Coban, *Tuerckheim 11607* (US); Pansamala, *Tuerckheim* (F, G, US); Tactic, *Standley 90542* (M). BAJA VERA PAZ—Santa Rosa, *Standley 69853* (F), *Tuerckheim II2312* (G, US). CHIQUIMULA—Jocotan, *Steyermark 31634, 31635* (F). ESCUINTLA—El Baul, *Rojas & Tonduz 56* (US); Escuintla, *Smith 1991* (G, US), *Standley 63420, 63919* (F), *89189, 89488, 89571* (F, M); Peinha, *Pittier 1793* (US); Rio Guacalate, *Standley 58277, 60179* (F); San Jose, *Standley 64000* (F). GUATEMALA—Chilloui, *Rojos 67* (G, US); Guatemala, *Ruano 405* (US), *Tonduz 814* (US). HUEHUETENANGO—Canibal, *Shannon 307* (US). IZABAL—Quirigua, *Standley 23857* (G, NY, US). JUTIAPA—Trapiche Vargas, *Steyermark 31790* (F). PETEN—La Libertad, *Aguilar 87* (A, M). QUEZALTENANGO—Palmar, *Kellerman 5811* (US); Los Positos, *Standley 67884* (F); Volcan Santa Maria, *Steyermark 33581* (F). RETALHULEU—Ajaxa, *Standley 88240* (F, M); Las Delicias, *Standley 88014, 88119* (F, M); Nueva Linda, *Standley 66536, 66539* (F); Retalhuleu, *Standley 66702, 66719, 66775* (F), *88262* (F, M); San Felipe, *Holway 694* (US). SACATEPEQUEZ—Antigua, *Standley 60322* (F); Volcan Acatenango, *Kellerman 4806* (US); Volcan de Agua, *Standley 59465* (F). SAN MARCOS —Ocos, *Steyermark 37878* (F); Tajumulco, *Steyermark 36665* (F). SANTA ROSA—Barberena, *Standley 77752* (F, M); Cuazacapan, *Standley 78616, 78644* (F, M); La Sepultura, *Standley 79410* (F, M); Taxisco, *Standley 79019* (F, M). SUCHITEPEQUEZ —Las Animas, *Shannon 384* (US); Mazatenango, *Holway 529* (US), *Kellerman 4962* (US), *Maxon & Hay 3470* (US); Patulul, *Standley 62146* (A, F). ZACAPA—Sierra de las Minas, *Steyermark 29878* (F); Zacapa, *Deam 161* (G, NY, US), *Kellerman 9019* (F), *Standley 72026* (F), *74212* (F, M).

HONDURAS: ATLANTIDA—Tela, *Standley 55780* (F, US). COMAYAGUA—Siguatepeque, *Yuncker, Dawson & Youse 5680* (F, G, M). YORO—Pijol, *C. & W. von Hagen 1104* (F, NY). WITHOUT EXACT LOCALITY—La Lima, *Johansen 29* (F).

SALVADOR: AHUACHAPAN—Ahuachapan, *Standley 19718a, 19855* (G, NY, US); without exact locality, *Padilla 193* (US), *197* (A, M, US). LA UNION—La Union, *Standley 20809* (G, US). SONSONATE—Armenia, *Standley 23520* (G, US); Finca Chilata, *Standley 19339* (G, NY, US); Izalco, *Standley 21837* (G, NY, US); Sonsonate, *Standley 22300* (G, NY, US).

NICARAGUA: MASAYA—Masaya, *Baker 163* (G, M, NY), *618* (US). DEPT. IN DOUBT—Braggman's Bluff, *Englesing 75, 94* (F); without exact locality, *Wright* (G, M, US).

COSTA RICA: CARTAGO—Carpintera Mt., *Stork 333* (US); Cartago, *Cooper 5719* (F, US); San Rafael, *Pittier 9030* (US). GUANACASTE—Cruz de Guanacaste, *Pittier 2770* (US); Hacienda Santa Maria, *Dodge & Thomas 6324* (M); Los Conventillos, *Tonduz 2884* (US); Nicoya, *Cooper 10367* (US), *Tonduz 13485* (G, M). PUNTARENAS—Santo Domingo del Golfo Dulce, *Tonduz 6982* (US). SAN JOSE—Guadaloupe, *Greenman 5433* (M); La Verbena, *Standley 32230* (US), *Tonduz 8946* (US); San Jose, *Tonduz 1092* (US). PROVINCE IN DOUBT: Ochonogo, *Pittier 59* (US).

PANAMA: CHIRIQUÍ—Bajo Mona, *Woodson & Schery 531* (M); Boquete, *Pittier 2925, 3138* (US); Pena Blanca, *Woodson & Schery 302* (M); Quebrada Velo, *Woodson & Schery 276* (M); New Switzerland, *Allen 1364* (F, G, M, NY); Peninsula de Burica, *Woodson & Schery 932* (M). COCLÉ—El Valle, *Allen 91* (A, G, M), *1176* (F, M) *P. & G. White 70* (G, M). DARIEN—Tucuti, *M. E. & R. A. Terry 1386* (M). PANAMÁ—Taboga Island, *Standley 27924* (US). VERAGUAS—Sona, *Allen 1045* (F, G, M).

WEST INDIES: BAHAMAS—Watlings Island, *Britton & Millspaugh 6145* (US). CUBA—Havana, *Britton & Wilson 4535* (F); Oriente, *Ekman 2976* (F); Pinar del Rio, *Palmer & Riley 597* (US), *van Hermann 253* (F, NY), *Wilson & Leon 11297* (US); Sierra de Omafe, *Leon 4745* (NY). JAMAICA—Blue Mountain Peak, *Hitchcock* (M); Cinchona, *Harris & Lawrence C15297* (US), *Marble 193* (NY), *Rehder* (A); Diabolo Mt., *Maxon & Killip 398* (US); Gordon Town, *Hart 571* (US); John Crow Mts., *Britton 3995* (NY); Latimer River, *Nichols 63* (NY, US); Lucea, *Britton 2917* (NY); Mandeville, *Britton 999* (NY); *Brown 78* (NY); Negril, *Britton & Hollick 2093* (NY); Port Antonio, *Hitchcock* (F, M), *Millspaugh 931* (F, NY), *Wight 22* (F, NY); Rio Grande, *Millspaugh 1920* (F); Walderston, *Harris 12863* (F, G, M, NY, US); Wavels Rock, *Fawcett 8022* (NY); without exact locality, *Alexander* (M). TRINIDAD—Queen's Royal College grounds, *Broadway 7690* (F, M); St. Ann's, *Broadway 7324* (NY).

COLOMBIA: ANTIOQUIA—San Geronimo, *Tomas 622* (US). ATLANTICO—Barranquilla, *Elias 655* (US). BOYACA—Uvita, *Cuatrecasas 1850* (US). CUNDINAMARCA—San Javier, *Aristé-Joseph* (US); Tabio, *Antonio 16E* (US). MAGDALENA—Aracataca, *Dugand & Barriga 2476* (US). SANTANDER—Badillo, *Pennell 3910* (NY, US).

The only character which separates this variety from varieties *penduliflorus* and *cubensis* is the flower size. Admittedly arbitrary limits are given for flower size, but this is necessary in view of the fact that complete intergradation occurs between these varieties. Here the flower is smaller and less robust than in var. *penduliflorus*, with the mature staminal column, as a rule, more exserted. On the other hand, the flowers are not as dwarfed as in var. *cubensis* and the staminal column is usually less exserted.

3g. **Malvaviscus arboreus** var. **palmanus** (Pittier & D. Smith) Schery, n. comb.

Malvaviscus palmanus Pittier & D. Smith in Bot. Gaz. **23**: 238. 1897.

Shrub or vine-like plants with upper branches, pedicels, and petioles generally thickly pubescent with short stellate hairs, sometimes also with longer straight hairs, or almost glabrous. Leaves entire, almost symmetrically elliptic, broadest at the middle, usually large when mature (as long as 20 cm. in extreme cases), 2 to 4 times as long as broad, with 3 prominent palmate veins from which smaller reticulate veins emerge almost at right-angles, stellate-pubescent on both surfaces; margins shallowly dentate or sinuate. Flowers large, usually 4–5 cm. long. Involucral lobes essentially linear. Mature staminal column exserted ⅓–⅕ its length.

Distribution: Costa Rica (see Map 2).

Specimens examined:

COSTA RICA: ALAJUELA—La Ventolera, *Standley 34685* (US); San Carlos, *Smith H1670* (F, M); San Ramon, *Brenes 5954, 13418, 21969, 21982, 22623* (F); Viento Fresco, *Standley & Torres 47926* (US); CARTAGO: Orosi, *Standley 39640, 39837* (US). GUANACASTE—El Silencio, *Valerio 66* (US); Tilaran, *Brenes 15630* (F), *Standley & Valerio 44605, 46238* (US). HEREDIA—San Frideo, *Pittier 14015* (US); Vara Blanca de Sarapiqui, *Skutch 3266* (A, M). SAN JOSE—La Hondura, *Standley 36585* (US); La Palma, *Maxon & Harvey 8004* (US), *Standley 33209* (US), *Stevens 301* (US), *Tonduz 7393* (F, G, M, US), *8089, 12465* (NY, US); PROVINCE IN DOUBT: Zarcero, *Smith H20* (F, M), *A316* (F); without exact locality, *Smith? 7393* (M).

M. arboreus var. *palmanus*, × approx. ⅓.

This variety approaches vars. *penduliflorus* and *mexicanus* but can be distinguished by its almost perfectly elliptic leaves.

3h. Malvaviscus arboreus var. **penduliflorus** (DC.) Schery, n. comb.

Malvaviscus penduliflorus Moc. & Sessé ex DC. Prodr. **1:** 445. 1824; ex A. DC. Calq. des Dess. *pl. 90.* 1874; Standl. in Contr. U. S. Nat. Herb. **23:** 774. 1923.

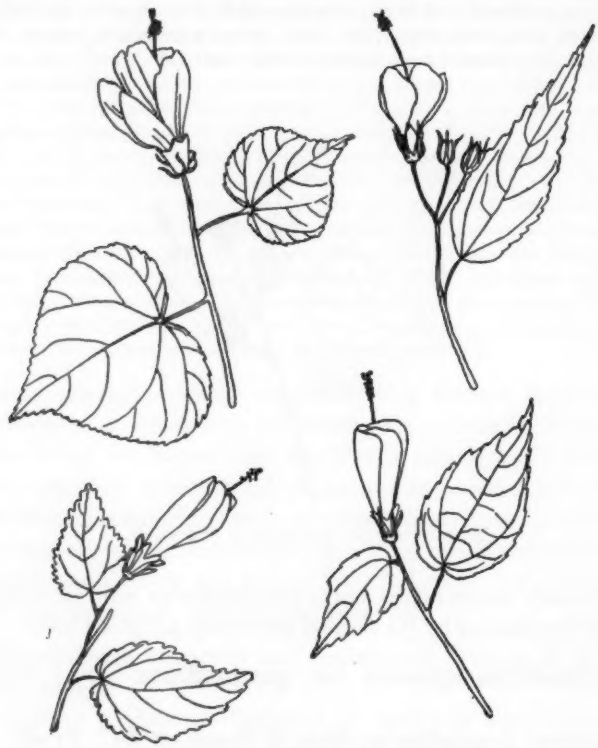
Malvaviscus oligotrichus Turcz. in Bull. Soc. Nat. Mosc. **31:** 190. 1858.

Malvaviscus glabrescens Planch. & Lind. ex Triana & Planch. in Ann. Sci. Nat. Bot. IV, **17:** 168. 1862, nomen nudum in synon. (= *M. oligotrichus* fide Triana & Planch.).

Malvaviscus lanceolata Rose in Contr. U. S. Nat. Herb. **5:** 175. 1899.

Malvaviscus Conzattii Greenm. in Field Col. Mus. Bot. **2:** 333. 1912; Standl. in Contr. U. S. Nat. Herb. **23:** 774. 1923.

Bushy or vine-like shrubs; upper branches, pedicels, and petioles with long (1.0–1.5 mm.) hairs, or glabrous. Leaves lanceolate or ovate-lanceolate, rounded or cordate at base, acute or attenuate at apex, serrate to sinuate-margined, variously pubescent. Flower robust, longer than 4.2 cm., often appearing abruptly truncate at



M. arboreus var. *penduliformis*, × approx. ⅓.

the tip in herbarium specimens. Involucral lobes essentially linear in southern part of plant range, often broader and more or less spatulate in northern part. Calyx more or less cylindric, somewhat longer than broad, glabrous or lightly haired. Mature staminal column exserted ⅓–¼ its length.

Distribution: widespread, from central Mexico to Colombia (see Map 4).

Specimens examined:

MEXICO: CHIAPAS—Chicharras, *Nelson 3807* (G, US); La Illusion, *Mell 2019* (US); San Cristobal, *Nelson 3170* (US). GUERRERO—Chilacayote, *Hinton 14181* (G); Petlacala,

Mexia 9094 (G, M, NY); Pilas Pasion Filo Mayor, *Hinton 10753* (F, M, US); Plan de Carrizo, *Hinton 11030* (G); San Marcos, *Nelson 2264* (US); Sierra Madre, *Langlasse 793* (G, US). JALISCO—Puerto Vallarta, *Mexia 1135* (A, F, M, NY, US); Santa Cruz de Vallarta, *Mexia 1267* (US); San Sebastian, *Mexia 1442* (A, F, G, M, NY, US). MEXICO—Temascaltepec, *Hinton 4014* (A, NY, US). MICHOACAN—Zitacuaro, *Hinton 13529* (G). MORELOS—Cuernavaca, *MacDaniels 305* (F), *Rose & Hough 4351* (US). OAXACA—Cafetal Concordia, *Morton & Makrinius 2391* (F, US), *Reko 3348* (US); Comaltepec, *Nelson 926* (US); Plunia, *Nelson 2500* (NY, US); San Pablo Huitzo, *Conzatti 1981* (F); Santo Domingo, *Conzatti 1683* (F, US); Yaveo, *Mexia 9204* (G, M, NY). PUEBLA—Piaxtla, *Nelson 2016* (US). QUERETARO—Cerro de las Campañas, *Arsène 10058* (F, M, US); without exact locality, *Agniel 10525* (A, F, G, M, US). SINALOA—without further locality, *Ortega 7327* (F). VERA CRUZ—Cordoba, *Schery 188* (M); Tampico, *Palmer 391* (M, NY, US). STATE IN DOUBT—from Mexican seed, *Rose 4027* (US).

GUATEMALA: ALTA VERA PAZ—Panzos, *Maxon & Hay 3080* (US); Saxoc, *Tuerckheim 8185* (US). BAJA VERA PAZ—Paujal, *Tuerckheim II1721* (US). CHIMALTENANGO—Quisache, *Standley 62039* (A, F), *62048* (F). IZABAL—Boca del Polochic, *Smith 1658a* (US); Quirigua, *Standley 24587* (G, NY, US), *72311* (F). QUEZALTENANGO—Aguas Amargas, *Standley 65416* (F); Chiquihuite, *Standley 68102, 68112* (F); Santa Maria de Jesus, *Standley 68236* (F, NY), *Steyermark 33386* (F); Volcan Zunil, *Skutch 878* (A, F). RETALHULEU—San Felipe, *Steyermark 34516* (F). SOLOLA—Volcan Atitlan, *Hatch & Wilson 360* (F).

HONDURAS: ATLANTIDA—La Ceiba, *Yuncker, Koepper & Wagner 8523* (F, M, NY); Tela, *Mitchell 131* (F, G), *Standley 53743* (A, F, US), *54021* (F), *54786* (A, F, US). SANTA BARBARA—San Pedro Sula, *Bangham 341* (A), *Thieme 5153* (G, NY, US). YORO—Guaymas district, *Standley 55493* (A, F, US); Quebrada Seca, *Standley 53926* (A, F, US); Progresso, *Standley 54987* (A, F, US). DEPT. IN DOUBT—Puerto Sierra, *Wilson 42* (NY, US).

NICARAGUA: ATAGALPA—Jinotega, *Grant 7298* (A).

COSTA RICA: ALAJUELA—Capulin, *Standley 40163* (US); Naranjo, *Stork 1828* (F); Palmira, *Smith 4215* (F); San Pedro, *Brenes 16998* (F). CARTAGO—Cartago, *Holway 276* (US), *Standley & Valerio 49600* (US), *Stork 2834* (F); Cerro Carpintera, *Dodge & Thomas 4784* (M), *Standley 35756* (US); Irazu Volcano?, *Pittier 13063* (US). GUANACASTE—Culebra Bay, *Pittier 12020* (US). HEREDIA—Puerto Viejo & Sarapiqui River, *Biolley 7403* (US); Santo Domingo del Roble, *Dodge & Goerger 9582* (F, M). LIMON—La Colombiana farm of United Fruit Co., *Standley 36978* (US). SAN JOSE—El General, *Skutch 2368* (A, G, M, NY, US); San Francisco de Guadalupe, *Pittier 13031* (US), *Tonduz 6973* (G, US); San Jose, *Biolley 43* (F), *Holway 402* (US), *Tonduz 7260* (US); Santa Maria de Dota, *Standley 41845* (F, US), *Standley & Valerio 43278* (F, US), *Stork 2975* (F); Tucurrique on Las Vueltas River, *Tonduz 13149* (US); Ciruelas River, *Tonduz 2218* (US); San Isidro Coronado, *Alfaro 32378* (F, US); Llanuras de Santa Clara, *Smith 6450* (US).

PANAMA: BOCAS DEL TORO—Almirante, *Cooper & Slater 26* (US), *Cooper 103* (F, NY); Bocas del Toro?, *Carleton 81* (NY, US); Changuinola River, *Dunlap 101* (F), *349* (F, G, US), *440* (F). CHIRIQUÍ—Bajo Chorro, *Davidson 68* (A, F, M); Bajo Mona, *Woodson & Schery 550* (M); Boquete, *Maxon 5000* (US); Cerro Punta, *Seibert 263* (A, M, NY); San Felix, *Pittier 5210* (NY, US). COCLÉ—El Valle, *Allen 1906* (M), *Woodson & Schery 188* (M). PANAMÁ—Rio la Maestra, *Allen 52* (A, G). PROVINCE IN DOUBT—western Panama, *Stork 101* (US).

COLOMBIA: BOLIVAR—Cartagena, *Killip & Smith 14052* (A, G, NY, US); Turbaco, *Killip & Smith 14187* (G, US). CAQUETA—Cordillera Oriental, *Cuatrecasas 9153* (US). MAGDALENA—Santa Marta, *Smith 492* (NY), *734* (A, F, G, M, NY, US), *735* (F, G, M, NY, US), *2727* (G, NY), *2816* (NY). SANTANDER—Barranca Bermeja, *Haught*

1532 (F, US); California, *Killip & Smith 16890* (G, US). DEPT. IN DOUBT—Fouinne?, *Arbelaez 2456* (US).

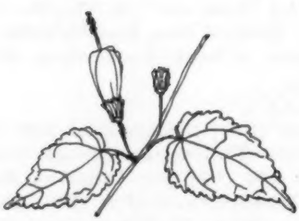
VENEZUELA: DISTRITO FEDERAL—Cerros del Avila, *Pittier 49* (NY, US); Galipan, *Pittier 83* (NY, US).

ECUADOR: PROVINCE IN DOUBT—La Chonta, *Rose, Pachano & Rose 23478* (NY, US).

This variety shows complete intergradation with var. *mexicanus* from which it must be separated rather arbitrarily. The difference between these varieties is in the flower, var. *penduliflorus* having a more robust flower, almost always greater in length than the arbitrary limit of 4.2 cm.

3i. **Malvaviscus arboreus** var. **sepium** (Schlecht.) Schery, n. comb.

Malvaviscus sepium Schlecht. in Linnaea **11**: 361. 1837; Standl. in Contr. U. S. Nat. Herb. **23**: 775. 1923, as syn.



M. arboreus var. *sepium* × approx. ⅓.

M. arboreus var. *Williamsii* × approx. ⅓.

Shrub with upper branches, pedicels, and petioles lightly or thickly pubescent with long (1.0–1.5 mm.) hairs, pubescence usually decurrent in ridges on petiole and stem. Leaves small (less than 10 cm. long, usually about 6 cm.), 1.5–3.5 times as long as broad, lanceolate to ovate-lanceolate, bluntly dentate, unlobed, upper leaf-surface predominantly straight-haired, lower surface with few to many straight hairs interspersed among stellate hairs. Flower small, 2.0–3.2 cm. long. Involucral lobes spatulate. Mature staminal column exserted ½–⅓ its length.

Distribution: Vera Cruz and occasional elsewhere in northeastern Mexico (see Map 2).

Specimens examined:

MEXICO: NUEVO LEON—Monterrey, *collectors unkonwn* (F, US). VERA CRUZ—Cordoba, *Bourgeau 1512, 1669* (G, US), *Greenman 191* (F, G); Coscomatepec, *Matuda 1310*

(F); Fortin, *Fisher 35506* (F); Jalapa, *Barnes, Chamberlain & Land 34* (F), *MacDaniels 944* (F), *Orcutt 2811* (F, M), *Plunkett 45* (F), *Pringle 7833* (G, US), *8202* (A, F, G, M, NY, US), *Rose & Hay 6184* (NY, US), *Rose & Hough 4245* (US); Mirador, *Mohr* (US); Nogales, *Seaton 300* (F, G, US); Orizaba, *Fisher 152* (US, F, M), *Mohr* (US), *Pringle 5914* (US); Azcuapan, *Purpus 7430* (G, M, US), *10729* (US).

This variety is close to var. *mexicanus* and is best distinguished by the spatulate involucral lobes, the small flowers and leaves, and the predominantly straight-haired pubescence of the upper leaf surface.

3j. **Malvaviscus arboreus** var. **Williamsii** (Ulbrich) Schery, n. comb.

Malvaviscus Williamsii Ulbrich in Notizblatt **11**: 545. 1932.

Shrub-like plant with upper branches, pedicels and petioles stellate-pubescent, often densely so. Leaves broadly lanceolate to triangular, cordate at base, unlobed or occasionally with small marginal projections, shallowly or deeply dentate, usually predominantly stellate-pubescent on both surfaces. Flowers large, 4–6 cm. long. Involucral lobes large, more or less foliaceous, lanceolate or ovate-lanceolate, 4–8 mm. broad near the base, more or less covering and concealing the long-cylindric, yellow-setose calyx. Mature staminal column exserted $\frac{1}{3}$–$\frac{1}{6}$ its length.

Distribution: Peru and Colombia (see Map 3).

Specimens examined:

COLOMBIA: PUTUMAYO—Umbria, *Klug 1712* (F). DEPT. IN DOUBT—Tocamet, *Schott 3* (F).

PERU: LORETO—Florida, *Klug 2077* (A, F, G, M, NY, US); Gamitanacocha, *Schunke 293* (A, F, NY, US).

This variety is close to var. *longifolius* which it resembles especially in calyx and leaf characters. However, it is the only variety with large, broad involucral lobes.

PAVONIA Cav.

4. **Pavonia firmiflora** Schery, n. sp.

Frutex undique stellato-pubescens; foliis maturis subrotundis, magnis, ca. 14 cm. longis, 12 cm. latis, aliquid 3–5-lobatis lobis mediis prominentibus, profunde cordatis, subtus pallidioribus et pubescentioribus, 7–9 venis prominentibus palmatis; petiolis folia aequantibus vel longioribus; floribus terminalibus brevi-racemiformibus; pedicellis 0.5–6.0 cm. longis; involucris subpatelliformibus ca. 8–9-lobatis, stellato-pubescentissimis, lobis linearibus, acutis; calycibus 1.0–1.5 cm. diametro, extus stellato-pubescentibus,

intus brevi-mollissimis, 5-lobatis, lobis lanceolatis; petalis obovatis, inaequilateralibus, retusis, non-auriculatis, 3.5–4.0 cm. longis; tubis staminalibus non exsertis, columniformibus, supra medium in filamenta congesta monanthera divisis, apice nudis, dentatis; ovariis subglobosis, rigide pubescentissimis, 5-carpellatis, carpellis uniovulatis et monoseminatis; stylis 10; fructibus juventate rigide pubescentissimis; seminibus subreniformibus, glabris.

Distribution: Jalisco, Mexico (see Map 6).

Specimens examined:

MEXICO: JALISCO—Tequila, *Pringle 5447* (F, G, M TYPE, NY, US).

Pavonia firmiflora, × approx. ⅓.

The Pringle specimens have for almost 50 years been labeled in herbaria as "*Malvaviscus acerifolius* Presl. (ex. char.)." Only this collection *(Pringle 5447)* has ever been made of specimens referable to the new species, *P. firmiflora.* The specimens differ from those of the original description of *Malvaviscus acerifolius* especially in having stiffly pubescent fruit and a shortened staminal column. A comparison of *Pavonia firmiflora* with a photograph of the *M. acerifolius* type specimen shows *P. firmiflora* to have a coarser, stouter appearance and different leaf texture.

Pavonia firmiflora is close to *Pavonia Palmeri* (Baker) Schery (formerly *Malvaviscus Palmeri),* but has much larger flowers, a condensed inflorescence, and only slightly lobed leaves. It is possible that *P. firmiflora* is a hybrid between *Pavonia Palmeri* and

perhaps *Malvaviscus candidus.* The fact that only one collection has ever been made would tend to support this view.

The border-line between *Pavonia* and *Malvaviscus* is vague. It is difficult to tell where a fleshy fruit stops and a dry fruit begins, to use this classical character of demarcation between *Malvaviscus* and *Pavonia.* This is true of *Pavonia firmiflora;* yet *P. firmiflora* is so similar to *P. Palmeri* that inclusion in the genus *Pavonia* seems entirely warranted, especially since *P. firmiflora* does not have auriculate petals, an additional definite character of *Pavonia,* suggested in the introduction to this monograph for use in distinguishing between *Malvaviscus* and *Pavonia.*

Pavonia Palmeri, × approx. ⅓.

The whole *P. firmiflora* plant has a coarse, dense, stellate pubescence. The cordate leaves are slightly lobate, a lighter gray color and more densely pubescent on the under side than above. The inflorescence is almost a condensed raceme, although occasional flowers are axillary in the upper leaves. The involucre is broad, with narrow linear-lanceolate lobes, shorter than the robust calyx. The calyx is minutely pannose within, with a circular bare area at the base surrounding the 5-carpellate densely haired ovary. There is one subreniform seed almost completely filling each carpel.

5. Pavonia Palmeri (Baker) Schery, n. comb.

Malvaviscus Palmeri Baker f. ex Rose in Contr. U. S. Nat. Herb. **3**: 313. 1895.

Malvaviscus cinereus Baker f. ex Robins. & Greenm. in Am. Jour. Sci. III, **50**: 176. 1895, nomen; E. G. Baker in Jour. Bot. **37**: 347. 1899.

Pavonia amplifolia Standl. in Pub. Field Mus. Bot. **4**: 230. 1929.

Distribution: western Mexico (see Map 6).

Specimens examined:

MEXICO: JALISCO—San Sebastian, *Mexia 1480* (F, G, M), *Nelson 4061* (G, US). NAYARIT—Tepic, *Palmer 1835*, in part (F, G), *1990* (F, G, NY, US).

The transfer of this species from *Malvaviscus* to *Pavonia* is made on the basis of the general structure of flower and fruit. The petals are not auriculate and the fruit can scarcely be termed "fleshy."

EXCLUDED SPECIES

Malvaviscus cinereus Baker f. ex Rob. & Greenm. in Am. Jour. Sci. III, **50**: 176. 1895, nomen subnudum; E. G. Baker in Jour. Bot. **37**: 347. 1899 = **Pavonia Palmeri** (Baker) Schery.

Malvaviscus coccineus Medic. Malv. 49. 1787 = **Hibiscus coccineus** Walt., fide Ind. Kew., probably **Pavonia** sp.

Malvaviscus floridanus Nutt. in Jour. Acad. Phila. **7**: 89. 1834 = **Hibiscus Bancroftianus** Macfad., fide Ind. Kew.

Malvaviscus fragilis Bory ex DC. Prodr. **1**: 446. 1824, as syn. = **Hibiscus liliiflorus** Cav., fide Ind. Kew. *(H. fragilis* DC. loc. cit).

Malvaviscus longifolius Spach, Hist. Veg. Phan. **3**: 370. 1834 = **Pavonia longifolia** A. St. Hil., fide Ind. Kew.

Malvaviscus montanus Mart. ex Garcke, Jahrb. Bot. Gart. Berlin **1**: 222. 1881 = **Pavonia montana** Garcke, fide Ind. Kew.

Malvaviscus multiflorus Spach, loc. cit. 1834 = **Pavonia multiflora** A. St. Hil., fide Ind. Kew.

Malvaviscus Palmeri Baker f. ex Rose in Contr. U. S. Nat. Herb. **3**: 313. 1895 = **Pavonia Palmeri** (Baker) Schery (see above).

Malvaviscus populifolius Presl, Reliq. Haenk. **2**: 135. 1853 = **Hibiscus** sp., as judged from the description.

Malvaviscus populneus Gaertn. Fruct. **2**: 253, *pl. 135, fig. 3.* 1791 = **Thespesia populnea** Soland., fide Ind. Kew.

Malvaviscus puniceus Bory ex DC. loc. cit. 446. 1824, as syn. = **Hibiscus liliiflorus** Cav., fide Ind. Kew.

Malvaviscus rosa-sinensis Moench ex Steud. Nom. Bot. ed. 2. **1**: 760. 1841 = **Hibiscus rosa-sinensis** L., fide Steud.

SPECIES OF DOUBTFUL STATUS

Achania cordata Nees & Mart. in Nov. Act. Nat. Cur. **11**: 99. 1823, not *Malvaviscus*, probably *Pavonia*. Same as *Pavonia coccinea* Willd., fide Nees & Mart.

Achania floridana Raf. New Fl. N. Am. 1: 4. 1836? = **Hibiscus Bancroftianus** Macfad. *(H. floridanus* Shuttlew.), fide Ind. Kew.

Achania Poeppigii Spreng. Syst. **3**: 100. 1826 = **Hibiscus Poeppigii** Garcke, fide Ind. Kew. (see *Malvaviscus Poeppigii).*

Achania stylosa Schrank in Flora **2**: 449. 1819, nomen dubium.

Achania tomentosa Sterler ex Steud. Nom. Bot. ed. 2, **1**: 12. 1841, nomen nudum.

Anotea chlorantha (Malvaviscus chloranthus) Kth. ex Ulbrich in Fedde's Rep. Spec. Nov. **14**: 108. 1915, probably **Pavonia** sp. as judged from photograph of type and from the description.

Anotea flavida (DC.) Ulbrich, loc. cit. 109. 1915, genus and species doubtful, probably **Pavonia** sp.

Malvaviscus flavidus Moc. & Sessé ex DC. Prodr. **1**: 446. 1824, genus and species doubtful, probably **Pavonia** sp.

Malvaviscus pleurantherus Moc. & Sessé ex DC. loc. cit. 1824, genus and species doubtful.

Malvaviscus pleurogonus Moc. & Sessé ex DC. loc. cit. 1824, genus and species doubtful.

Malvaviscus Poeppigii (Spreng.) G. Don, Gen. Syst. Dichl. Pl. **1**: 475. 1831, nomen dubium = **Hibiscus Poeppigii** Garcke, fide Ind. Kew. Perhaps, were the description more complete and definitive, this name should be included as a synonym of **Malvaviscus arboreus** var. **mexicanus.**

Index to Specimens Cited

The number in italics refers to the collection number, the number in parentheses to the species or variety under which the specimen is cited: (1)—*M. candidus;* (3)—*M. arboreus;* (3a)—var. *brihondus;* (3b)—var. *cubensis;* (3c)—var. *Drummondii;* (3d)—var. *Hintoni;* (3e)—var. *longifolius;* (3f)—var. *mexicanus;* (3g)—var. *palmanus;* (3h)—var. *penduliflorus;* (3i)—var. *sepium;* (3j)—var. *Williamsii;* (4)—*P. firmiflora;* (5)—*P. Palmeri.*

Agniel, Bro. *10525* (3h); *10621* (1).
Aguilar, M. *87* (3f).
Alexander, R. C. — (3f).
Alfaro, A. *32378* (3h).
Allart, A. *76* (3c).
Allen, P. H. *52* (3c); *91, 1045, 1176, 1364* (3f); *1906* (3h).
André, E. K. *K862* (3e).
Antonio, Bro. *16E* (3f).
Arbelaez, E. P. & J. Cuatrecasas. *2456* (3h); *6565* (3).
Aristé-Joseph, Bro. *A975, 1060* (3); — (3f).
Arsène, Bro. G. *34* (3); *128, 389, 1957* (3f); *2729* (3, 3f); *5494* (3); *10058* (3h).

Artemio, Bro. *72* (3).

Baker, C. F. *7* (3); *163, 618* (3f); *824* (3).
—— & H. A. Van Hermann. *4253* (3b).
Bangham, C. M. *341* (3h).
Barber, H. S. *23* (3c).
Barnes, C. R., C. J. Chamberlain & W. J. G. Land. *34* (3i).
—— & W. J. G. Land. *203* (3).
Bartlett, H. H. *11069* (3c).
Berg, N. K. — (3c).
Berlandier, J. L. *566* (3f).
Biltmore Herb. *11079, a, b, c, d, & e* (3c).
Biolley, P. *43, 7403* (3h); *8977* (3).
Bodin, J. E. *129* (3c).
Bogusch, E. R. *115* (3c).
Botanic Station. *508* (3).
Bourgeau, E. *1512, 1669* (3i).
Brace, L. J. K. *1527, 3541* (3b).
Brandegee, T. S. — (3f).
Brenes, A. M. *5954, 13418, 15630* (3g); *16967* (3); *16998* (3h); *17050, 19308, 21480, 21917* (3); *21969, 21982, 22623* (3g).
Britton, N. L. *999, 2917, 3995* (3f).
—— & J. F. Cowell. *9902* (3b).
—— & A. Hollick. *2093* (3f).
—— & C. F. Millspaugh. *2442* (3b); *6145* (3f).
—— & P. Wilson. *511* (3); *4535* (3f); *14032* (3b).
——, —— & A. D. Selby. *14498* (3b).
Broadway, W. E. *7324, 7690* (3f).
Brown, S. *78* (3f).
Buckley, S. B. — (3c).
Bush, B. F. *312, 1211* (3c).

Calderon, S. *121* (3).
Cardenas, R. *375* (3d).
Carleton, M. A. *81* (3h).
Chapman, A. W. — (3c).
Chase, V. H. *7073* (3); *7481* (3f).
Chaves, D. *75* (3).
Clark, O. M. *3977* (3c).
Clemens, J. *609, 610* (3c).
Conzatti, C. *1683, 1981* (3h); *3948, 4430* (3f).
—— & Camino. *2447* (3).
—— & V. Gonzalez. *27* (3).
Cook, O. F. & R. D. Martin. *63, 197* (3).
Cooper, G. P. *54* (3); *103* (3h).
—— & G. M. Slater. *26* (3h).
Cooper, J. J. *5719, 10367* (3f).
Cuatrecasas, J. *1850* (3f); *9153* (3h).
Curtiss, A. H. *726* (3); — (3c).

Davidson, M. E. *68* (3h).
Deam, C. C. *161* (3f).
Delgado, E. *271* (3e).
Dewey, L. F. — (3b).
Dixon, R. A. *441* (3b).
Dodge, C. W. & V. F. Goerger. *9582* (3h).
—— & W. S. Thomas. *4784* (3h); *6324* (3f).
Drushel, J. A. *2844* (3c).
Dugand, A. *887* (3e).
—— & Barriga. *2476* (3f).
Duges, A. *173* (3); *281* (1).
Dunlap, V. C. *101, 349, 440* (3h).

Edwards, M. T. *482* (3f); *818* (3).
Eggert, H. — (3c).
Ekman, E. L. *2976* (3f); *10069* (3).
Elias, Bro. *428* (3e); *655* (3f).
Emrick, C. M. *167* (3f).
Englesing, F. C. *75, 94* (3f).

Fawcett, W. *8022* (3f).
Fendler, A. *101* (3e).
Ferris, R. S. *5436, 6078, 6231* (3f).
—— & C. D. Duncan. *3150* (3c).
Fisher, G. L. *125* (3c); *152* (3i); *191* (3c); *35506*, — (3).
Fredholm, A. *6413* (3c).

Gale. — (3c).
Garnier, Bro. A. *291* (3).
Gaumer, G. F. *580, 1858*, — (3f).
—— & sons. *23361, 23523* (3f); *23686* (3, 3f).
Gehriger, W. *565* (3).
Gentle, P. H. *208* (3f); *870, 2373* (3a).
Gentry, H. S. *5258* (3).
Ghiesbreght, A. *642* (3).
Goldman, E. A. *22* (3f); *461* (3); *578* (3f); *864, 904, 940, 983* (3).
Gomez, R. *822* (3).
Grant. *7298* (3h).
Greenman, J. M. *49* (3f); *191* (3i); *443, 5433* (3f); *5665, 5712* (3).
Gregg, J. *1110* (3).
Groth, H. A. *209* (3c).

Hagen, C. & W. von. *1104* (3f).
Hall, E. *53* (3c).

Hanson, H. C. *2* (3c); — (3f).
Harris, J. A. *11143, 11835* (3).
—— & J. V. Lawrence. *C15297* (3f).
Harris, W. *12863* (3f).
Hart, J. H. *571* (3f); — (3b).
Hatch, W. R., & C. L. Wilson. *360* (3h).
Haught, O. *1532* (3h).
Havard, V. — (3c).
Heller, A. A. *1833* (3c).
Heriberto, Bro. *244* (3e).
Heyde, E. T. *193a* (3).
—— & E. Lux. *2920, 6071* (3).
Hinton, G. B. *690* (3d); *3861* (3); *3928* (3d); *4014* (3h); *4289* (3d); *4563* (3f); *5057* (3d); *5145* (3); *5254* (3f); *5371* (3d); *6719* (3f); *7184* (3); *7912* (3d); *9597* (3f); *10753* (3h); *10897* (3f); *11030, 13529, 14181* (3h).
Hioram. *3976* (3).
Hitchcock, A. L. *21141* (3e); — (3b); — (3f).
Holton. *748* (3).
Holway, E. W. D. *276, 402* (3h); *529, 694* (3f); *766* (3).
Howell, A. H. *247* (3c).

Jermy, G. *191, 271, 707,* — (3c).
Johansen, H. *29* (3f).

Karling, J. S. *43* (3a).
Kellerman, W. A. *4806* (3f); *4819* (3); *4962* (3f); *4990* (3b); *5811, 9019* (3f).
Kenoyer, L. A. *A373, 772a* (3); *772* (3f).
Killip, E. P. *13511* (1).
—— & A. C. Smith. *14052, 14187* (3h); *16087* (3); *16890* (3h); *20179* (3); *23065* (3e); *24714* (3); *26648* (3e).
Klug, G. *1712, 2077* (3j); *3015* (3); *3919, 4382* (3e).
Krukoff, B. A. *4589* (3e); *5150* (3).

Lamb, F. H. *399* (3).
Langlasse, E. *793* (3h); *924* (3f).
Leon, Bro. *695* (3); *4745* (3f).
LeSueur, H. *283* (3c).
Letterman, G. W. *66, 102* (3c).
Lindheimer, F. *25, 84, 685,* — (3c).
Lloyd, C. A. *1108* (3b).
Lundell, C. L. *13, 52, 480* (3a); *970* (3); *4246* (3a); *4890* (3f).
Lyonnet, E. *1298, 1323* (3).

McCormick, P. — (3c).
MacDaniels, D. H. *191* (3f); *305* (3h); *526* (1); *944* (3i).
Maltby, T. S. *1* (3).
Marble. *193* (3f).
Matuda, E. *83* (3f); *95* (3); *1310* (3i); *2153* (3f).
Maxon, W. R. *5000* (3f).
—— & A. D. Harvey. *8004* (3g).
——, —— & A. T. Valentine. *7275, 7353, 7450* (3).
—— & R. Hay. *3080* (3h); *3470* (3f).
—— & E. P. Killip. *398* (3f).
Mell, C. D. *2019* (3h).
Metz. — (3c).
Mexia, Y. *1023* (3f); *1135, 1267, 1442* (3h); *1480* (5); *9094, 9204* (3h).
Meyer, W. C. *163* (3a).
Millspaugh, C. F. *42, 931* (3f); *1166, 1313* (3b); *1728, 1920* (3f).
Mitchell, E. R. *131* (3h).
Mohr, C. H. — (3c); — (3i).
Morton, C. V. & E. Makrinius. *2391* (3h).
Mutis, J. C. *2262* (3e).

Nelson, E. W. *348* (3f); *363* (3b); *405* (3f); *926* (3h); *1223, 1256* (3f); *2016, 2264, 2500* (3h); *3005* (3); *3170* (3h); *3346* (3f); *3454, 3563* (3); *3807* (3h); *3835* (3); *4061* (5), *4392* (3c).
Nichols, G. E. *63* (3f).
Northrop, J. I. *3* (3).

Orcutt, C. R. *2811* (3i); *2899* (3f); *4294* (3).
Ortega, J. G. *5116* (3f); *5183, 6114, 6444* (3); *7327* (3h).

Padilla, S. A. *193, 197* (3f).
Palmer, Edw. *94, 115, 387* (3c); *391* (3h); *470* (3); *525* (3c); *536* (3f); *686* (1); *963* (3f); *1835, 1990* (5).
Palmer, E. J. *6609, 8584, 10756* (3c).
Palmer, W. & J. H. Riley. *597* (3f); *697* (3b).
Pennell, F. W. *3910, 17975* (3f).
Plunkett, O. A. *45* (3i); *140* (3f).
Pittier, E. *49, 83* (3h).
Pittier, H. *59* (3f); *1749* (3); *1793, 2770, 2925, 3138* (3f); *5210* (3h); *7121* (3); *9030* (3f); *10575* (3h); *11116* (3); *12020* (3h); *13014* (3); *13031, 13063* (3h); *14015* (3g).

Popenoe, W. 690 (3).
Pringle, C. G. 1959 (3e); 4132 (1); 4923 (3f); 5447 (4); 5609 (3); 5914 (3i); 5973 (3); 7833, 8202 (3i); 8232, 8498, 9275, 9455 (3); 9662 (3f); 9688 (3).
Purpus, C. A. 7430, 10729 (3i).

Record, S. J. — (3a).
Rehder, A. — (3f).
Reko, B. P. 3348 (3h).
Renson, C. 8 (3).
Reverchon, J. 1195, 1197, 3827, — (3c).
Roig, J. T. 3160 (3b).
Rojas, T. 67 (3f).
—— & A. Tonduz. 56 (3f).
Rose, J. N. 2670 (1); 4027 (3h).
—— & R. Hay. 5302 (3); 6184 (3i); 6354 (1).
—— & W. Hough. 4237 (3); 4245 (3i); 4351 (3h); 4363 (3); 4587 (3f); 4883 (3e).
——, A. Pachano & C. Rose. 23478 (3h).
—— & J. H. Painter. 7541 (3).
——, —— & G. Rose. 8497 (3); 10220 (3f).
—— & G. Rose. 22595 (3).
—— & P. G. Russell. 24292 (3f).
——, P. C. Standley & P. G. Russell. 13939, 14096, 14210 (3).
Rothrock, J. T. 180, 237 (3b).
Ruano, M. 405 (3f).
Runyon, R. — (3c).
Rusby, H. H. & F. W. Pennell. 143, 170 (3).

Saer, J. 65 (3e).
Sargent, C. S. — (3c).
Schery, R. W. 188 (3h); 204, 206 (3).
Schipp, W. A. 708 (3a).
Schott, A. 3 (3i); 177, 271 (3f); 643 (3); — (3f).
Schunke, C. 21, A116 (3); 293 (3j); 1492 (3).
Seaton, H. E. 300 (3i).
Seibert, R. J. 263 (3h).
Seler, G. & E. 2681 (3); 4913 (3f).
Shannon, W. C. 307, 384 (3f); 419 (3).
Skutch, A. F. 541 (3); 878 (3h); 1021 (3); 2368 (3h); 3266 (3g).
Smith, A. H20, A316, H1670 (3g); 4215 (3h).
Smith, C. L. 118 (3); 296, 638, 1023 & 1030, 1030 (3f).
Smith, H. H. 492, 734, 735, 2727, 2816 (3h).
Smith, J. D. 1658A (3h); 1991 (3f); 6450 (3h); 7393 (3g).
Solis, F. 266 (3).
Standley, P. C. 19339, 19718a, 19855, 20809 (3f); 21021, 21402 (3); 21837, 22300, (3f); 22690, 22975 (3); 23520, 23857 (3f); 24587 (3h); 27924, 32230 (3f); 33209 (3g); 33368 (3); 34685 (3g); 35756 (3h); 36585 (3g); 36987 (3h); 39640, 39837 (3g); 40163, 41854 (3h); 42268, 52756 (3); 53743, 53926, 54021 (3h); 54127 (3); 54786, 54987, 55493 (3h); 55780, 58277, 59465, 60179, 60322 (3f); 61127, 61483 (3); 62039, 62048 (3h); 62146 (3f); 63263 (3); 63420, 63919, 64000 (3f); 65416 (3h); 66536, (3f); 66190 (3); 66539, 66702, 66719, 66775, 67894 (3f); 68102, 68112, 68236 (3h); 69853, 72026 (3f); 72311 (3h); 74212 (3); 75248 (3); 77752, 78616, 78644, 79019, 79410 (3f); 79935, 81929 (3); 88014, 88119, 88240, 89189, 89488, 89571, 90542 (3f).
—— & R. Torres. 47926 (3g).
—— & J. Valerio. 43278 (3h); 44605, 46238 (3g); 49600 (3h).
Steere, W. C. 1127, 1618, 1642 (3f); 1924, 2020 (3).
Stevens, F. L. 301 (3g).
Steyermark, J. A. 29878 (3f); 30360, 30505, 30615 (3); 31634, 31635, 31790 (3f); 31959, 32851 (3); 33386 (3h); 33581 (3f); 34516 (3h); 34989, 36553 (3); 38665, 37878 (3f).
Stork, H. E. 101 (3h); 333 (3f); 1828, 2834, 2975 (3h).

Tamayo, F. 385 (3e).
Terry, R. A. 1386 (3f).
Tharp, B. C. — (3c).
Thieme, C. 5153 (3h); 5168 (3).
Thurrow, W. F. — (3c).
Tomas, Bro. 622 (3f).
Tonduz, A. 814, 1092 (3f); 2218 (3h); 2884 (3f); 6973 (3h); 6982 (3f); 7260 (3h); 7291 (3f); 7393, 8089 (3g); 8036 (3h); 8946 (3f); 11631, 11693 (3); 12485 (3g); 13149 (3h); 13485 (3f); 17554 (3).
Townsend, C. H. T. 49 (3c).
Tracy, S. M. 7476 (3c).

Trelease, W. — (3c).
Triana, J. J. *388, 3132* (3).
Tuerckheim, H. von. *II607, 882* (3f); *II1721* (3h); *II2312* (3f); *8185* (3h).

Ule, E. *9591* (3e).
University of Lima. *13, 75* (3).

Valerio, J. *66* (3g); *67* (3).
Valerio, M. *220* (3).
Van Herman, H. A. *253* (3f).
Vogl, Fr. C. *76* (3e).

Ward, L. F. — (3c).
Warner, S. R. — (3c).
West, J. *3552* (3).
White, P. & G. *70* (3f).
Wight, A. E. *22* (3f).
Wilkinson, E. H. *47, 102,* — (3c).
Williams, G. B. *70* (3c).
Williams, L. *506, 2675, 8068* (3e); *8336* (3f); *8977* (3); *9189, 9219* (3f).
Wilson, P. *42* (3h).
—— & Bro. Leon. *11297* (3f).
Woodson, R. E. & R. W. Schery. *188* (3h); *276, 302, 531* (3f); *550* (3h); *932* (3f).
Wooton, E. O. — (3).
Worthen, G. C. — (3).
Wright, C. *2064, 2065, 2068* (3c).
Wright, W. G. *1348* (3f).

Yuncker, T. G., R. F. Dawson & H. R. Youse. *5680* (3f); *5879, 5880, 6239* (3).
Yuncker, T. G., J. M. Koepper & K. A. Wagner. *8523* (3h).

Index to Specific and Varietal Names

New names, varieties and combinations are printed in **bold-face** type, synonyms in *italics*, and valid names in Roman type.

42]

Explanation of Plate

PLATE 14

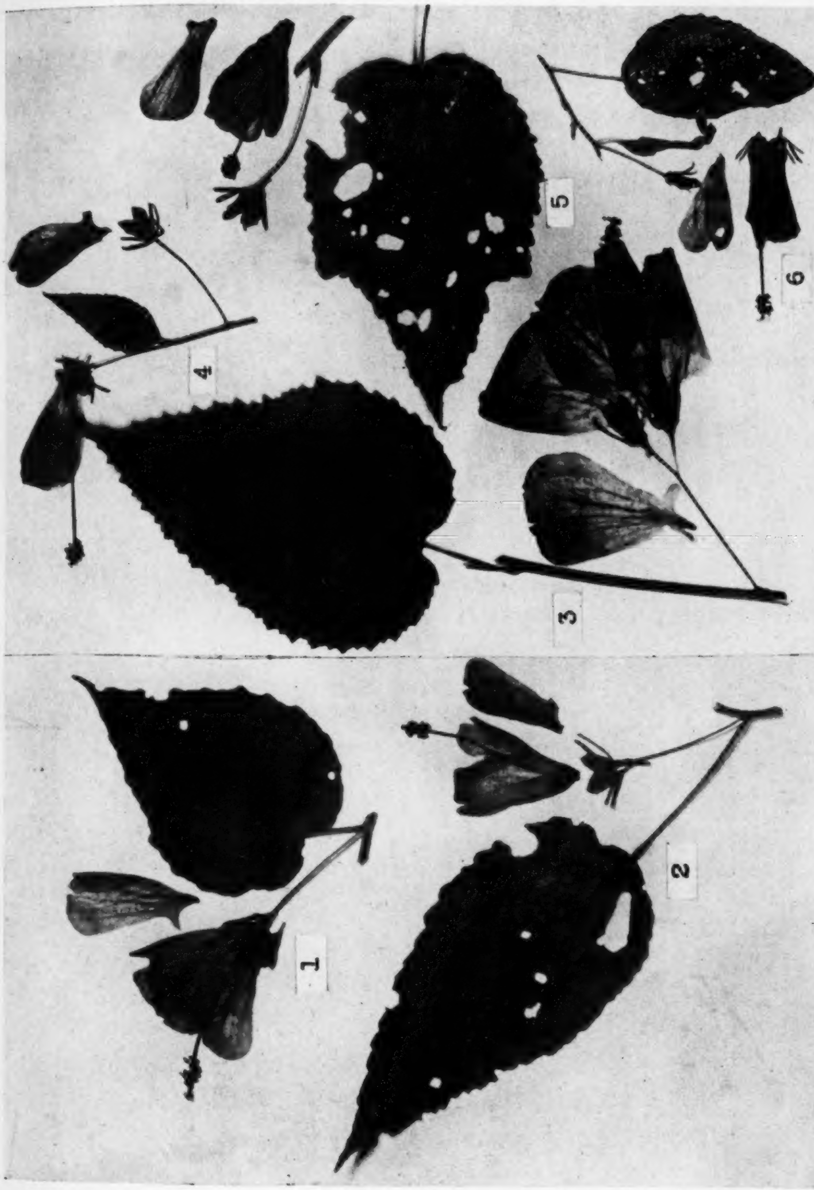
Cutting from a plant of *Malvaviscus arboreus* var. *penduliflorus*, showing unusual morphology in the first formed leaves.

SCHERY—MONOGRAPH OF MALVAVISCUS

Explanation of Plate

PLATE 15

Figs. 1–6. Six different specimens of *M. arboreus* vars. *mexicanus* and *penduliflorus* collected in the same locality in Chiriquí, Panama. Note the variation in leaf and petal shape, number and form of calyx and involucral lobes, differences in leaf margin, etc. The specimen of fig. 3 would be classified as var. *penduliflorus* on the basis of flower size, while the other specimens would fall into the var. *mexicanus* group. The specimens of figs. 1 and 2 would be almost on the border-line between these two varieties. × ½.



SCHERY—MONOGRAPH OF MALVAVISCUS

Explanation of Plate

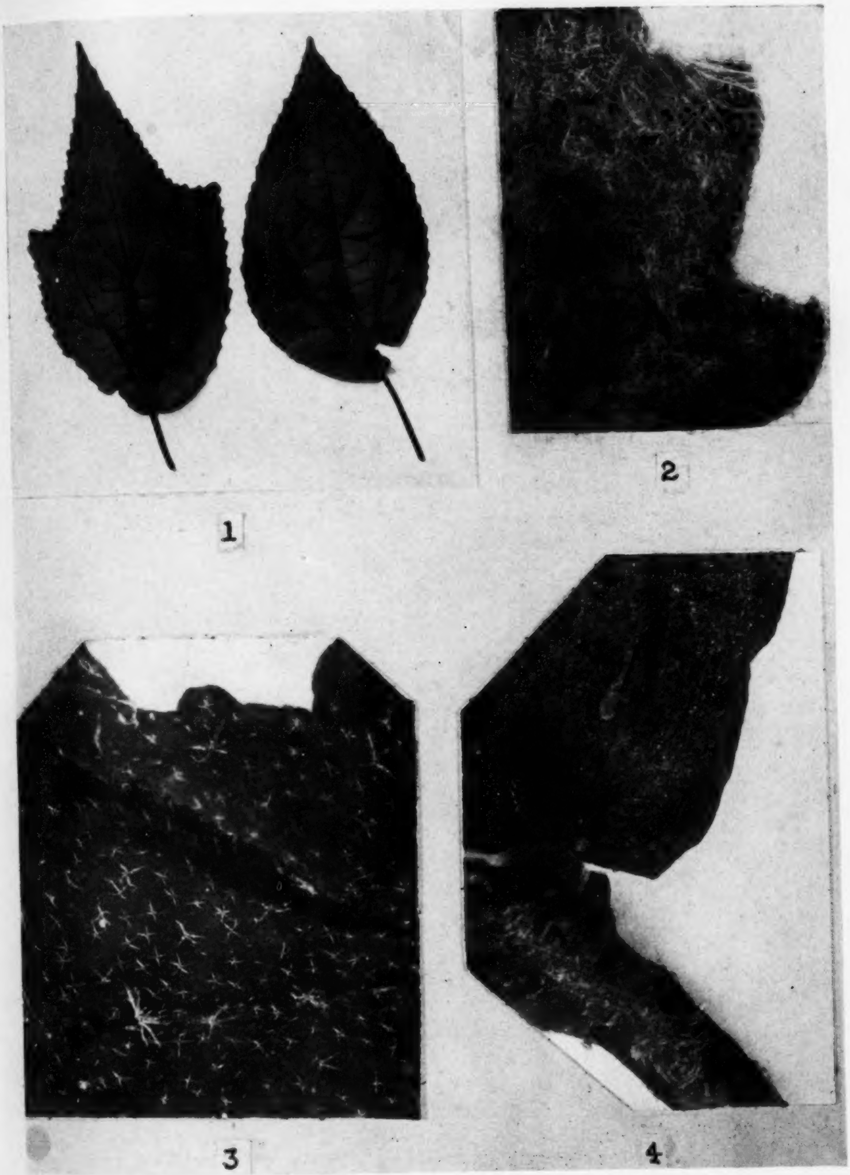
PLATE 16

Fig. 1. Two leaves from the same plant of *M. arboreus* var. *penduliflorus* growing in the Missouri Botanical Garden greenhouse. × ⅔.

Fig. 2. Dense velvety pubescence of lower surface of a leaf of *M. arboreus*. × 10.

Fig. 3. Stellate pubescence on upper surface of a leaf of *M. arboreus* var. *brihondus*. Note occasional larger hairs. × 10.

Fig. 4. Glabrous upper surface of a leaf of *M. arboreus* var. *mexicanus*. Note the longitudinal ridge of hairs on the upper side of the petiole in this specimen. × 10.



SCHERY—MONOGRAPH OF MALVAVISCUS

Explanation of Plate

PLATE 17

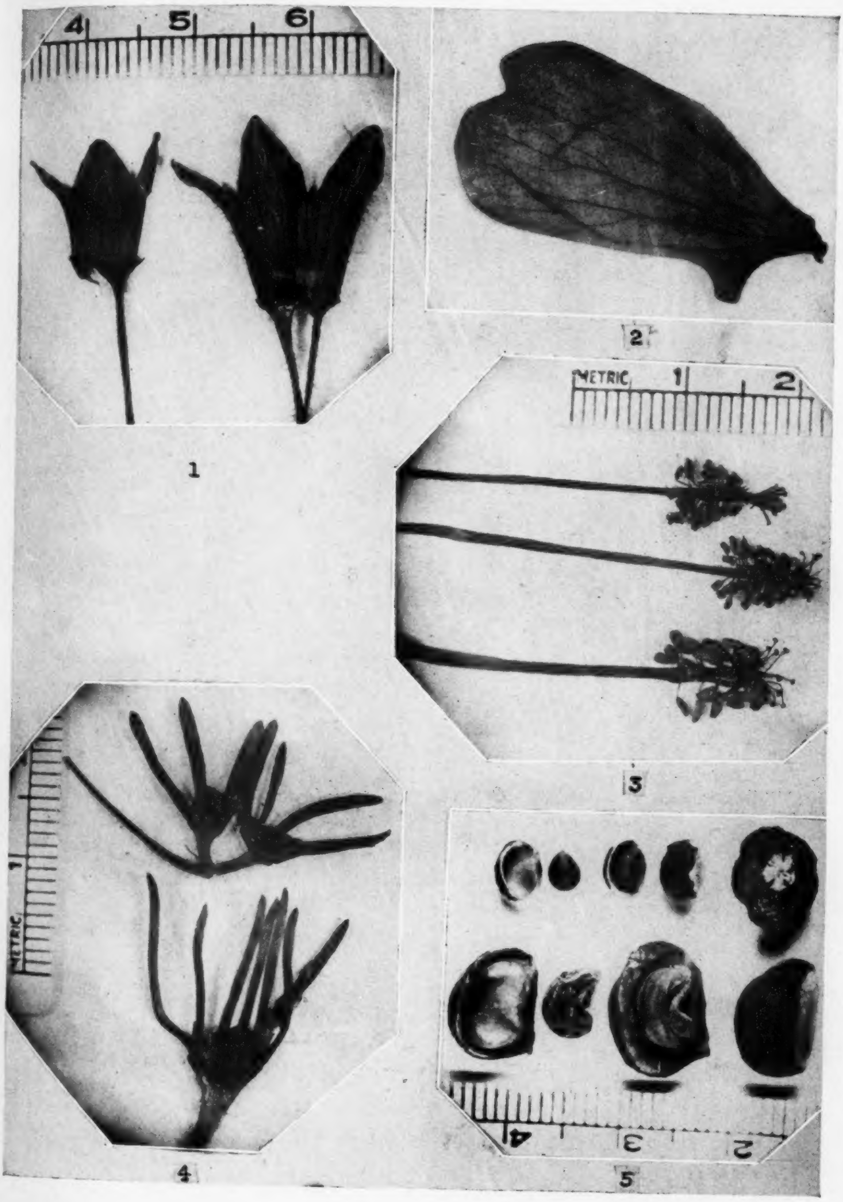
Fig. 1. Calyx of *M. arboreus* var. *mexicanus* with other floral organs removed: left—external view; right—calyx split open to show inner surfaces. × 4.

Fig. 2. Single petal of *M. arboreus* var. *mexicanus*. × 2.5.

Fig. 3. Upper portion of staminal column in three specimens of *M. arboreus* var. *mexicanus*. Note the erect position of the style branches and the five-toothed tip of the staminal column in the younger (upper) specimen. × 4.

Fig. 4. Involucre of *M. arboreus* var. *mexicanus* with all other floral organs removed: upper—involucre split with inner surfaces exposed; lower—external view. × 4.

Fig. 5. Upper row, from left to right: empty opened carpel, seed, seed in position in opened carpel, single unopened carpel, and mature fruit of *M. arboreus* var. *mexicanus*. Lower row: same for *M. candidus* except mature fruit is omitted. × 2.



SCHERY—MONOGRAPH OF MALVAVISCUS